

National Cooperative Highway Research Program

NCHRP Synthesis 243

**Methods for Capital Programming
and Project Selection**

A Synthesis of Highway Practice

**Transportation Research Board
National Research Council**

TRANSPORTATION RESEARCH BOARD EXECUTIVE COMMITTEE 1997

Officers

Chair

DAVID N. WORMLEY, *Dean of Engineering, Pennsylvania State University*

Vice Chair

SHARON D. BANKS, *General Manager, Alameda-Contra Costa Transit District, Oakland, California*

Executive Director

ROBERT E. SKINNER, JR., *Transportation Research Board, National Research Council*

Members

BRIAN J. L. BERRY, *Lloyd Viel Berkner Regental Professor, Bruton Center for Development Studies, University of Texas at Dallas*
LILLIAN C. BORRONE, *Director, Port Commerce Department, The Port Authority of New York and New Jersey (Past Chair, 1995)*
DAVID BURWELL, *President, Rails-to-Trails Conservancy*
E. DEAN CARLSON, *Secretary, Kansas Department of Transportation*
JAMES N. DENN, *Commissioner, Minnesota Department of Transportation*
JOHN W. FISHER, *Director, ATSSS Engineering Research Center, Lehigh University*
DENNIS J. FITZGERALD, *Executive Director, Capital District Transportation Authority*
DAVID R. GOODE, *Chairman, President, and CEO, Norfolk Southern Corporation*
DELON HAMPTON, *Chairman & CEO, Delon Hampton & Associates*
LESTER A. HOEL, *Hamilton Professor, University of Virginia, Department of Civil Engineering*
JAMES L. LAMMIE, *President & CEO, Parsons Brinckerhoff, Inc.*
BRADLEY L. MALLORY, *Secretary of Transportation, Commonwealth of Pennsylvania*
ROBERT E. MARTINEZ, *Secretary of Transportation, Commonwealth of Virginia*
JEFFREY J. MCCAIG, *President and CEO, Trimac Corporation*
MARSHALL W. MOORE, *Director, North Dakota Department of Transportation*
CRAIG E. PHILIP, *President, Ingram Barge Company*
ANDREA RINKER, *Deputy Executive Director, Port of Seattle*
JOHN M. SAMUELS, *Vice President-Operating Assets, Consolidated Rail Corporation*
WAYNE SHACKLEFORD, *Commissioner, Georgia Department of Transportation*
LESLIE STERMAN, *Executive Director of East-West Gateway Coordinating Council*
JOSEPH M. SUSSMAN, JR. *East Professor and Professor of Civil and Environmental Engineering, MIT (Past Chair, 1994)*
JAMES W. VAN LOBEN SELS, *Director, California Department of Transportation*
MARTIN WACHS, *Director, University of California Transportation Center, Berkeley, California*
DAVID L. WINSTEAD, *Secretary, Maryland Department of Transportation*

MIKE ACOTT, *President, National Asphalt Pavement Association (ex officio)*
ROY A. ALLEN, *Vice President, Research and Test Department, Association of American Railroads (ex officio)*
JOE N. BALLARD, *Chief of Engineers and Commander, U.S. Army Corps of Engineers (ex officio)*
ANDREW H. CARD, JR., *President & CEO, American Automobile Manufacturers Association (ex officio)*
THOMAS J. DONOHUE, *President and CEO, American Trucking Associations, Inc. (ex officio)*
THOMAS M. DOWNS, *Chairman & President, National Railroad Passenger Corporation (ex officio)*
FRANCIS B. FRANCOIS, *Executive Director, American Association of State Highway and Transportation Officials (ex officio)*
DAVID GARDINER, *Assistant Administrator, Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency (ex officio)*
JANE F. GARVEY, *Acting Federal Highway Administrator, U.S. Department of Transportation (ex officio)*
ALBERT J. HERBERGER, *Maritime Administrator, U.S. Department of Transportation (ex officio)*
T.R. LAKSHMANAN, *Director, Bureau of Transportation Statistics, U.S. Department of Transportation (ex officio)*
GORDON J. LINTON, *Federal Transit Administrator, U.S. Department of Transportation (ex officio)*
RICARDO MARTINEZ, *Administrator, National Highway Traffic Safety Administration (ex officio)*
WILLIAM W. MILLAR, *President, American Public Transit Association (ex officio)*
JOLENE M. MOLITORIS, *Federal Railroad Administrator, U.S. Department of Transportation (ex officio)*
DHARMENDRA K. (DAVE) SHARMA, *Administrator, Research & Special Programs Administration, U.S. Department of Transportation (ex officio)*
BARRY L. VALENTINE, *Acting Federal Aviation Administrator, U.S. Department of Transportation (ex officio)*

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Transportation Research Board Executive Committee Subcommittee for NCHRP

FRANCIS B. FRANCOIS, *American Association of State Highway and Transportation Officials*
LESTER A. HOEL, *University of Virginia*
ROBERT E. SKINNER, JR., *Transportation Research Board*

RODNEY E. SLATER, *Federal Highway Administration*
JAMES W. VAN LOBEN SELS, *California Department of Transportation*
DAVID N. WORMLEY, *Pennsylvania State University (Chair)*

Field of Special Projects Project Committee SP 20-5

KENNETH C. AFFERTON, *New Jersey Department of Transportation (Retired)*
GERALD L. ELLER, *Federal Highway Administration*
JOHN J. HENRY, *Pennsylvania Transportation Institute*
GLORIA J. JEFF, *Federal Highway Administration*
C. IAN MACGILLIVRAY, *Iowa Department of Transportation*
GENE E. OFSTEAD, *Minnesota Department of Transportation*
DAVID H. POPE, *Wyoming Department of Transportation*
EARL C. SHIRLEY, *Consulting Engineer*
JON P. UNDERWOOD, *Texas Dept. of Transportation (Chair)*
J. RICHARD YOUNG, JR., *Mississippi Department of Transportation*
RICHARD A. MCCOMB, *Federal Highway Administration (Liaison)*
ROBERT E. SPICHER, *Transportation Research Board (Liaison)*

Program Staff

ROBERT J. REILLY, *Director, Cooperative Research Programs*
CRAWFORD F. JENCKS, *Manager, NCHRP*
DAVID B. BEAL, *Senior Program Officer*
LLOYD R. CROWTHER, *Senior Program Officer*
B. RAY DERR, *Senior Program Officer*
AMIR N. HANNA, *Senior Program Officer*
EDWARD T. HARRIGAN, *Senior Program Officer*
RONALD D. MCCREADY, *Senior Program Officer*
KENNETH S. OPIELA, *Senior Program Officer*
EILEEN P. DELANEY, *Editor*

TRB Staff for NCHRP Project 20-5

STEPHEN R. GODWIN, *Director for Studies and Information Services* SALLY D. LIFF, *Senior Program Officer* STEPHEN F. MAHER, *Senior Program Officer*
LINDA S. MASON, *Editor*

National Cooperative Highway Research Program

Synthesis of Highway Practice 243

Methods for Capital Programming and Project Selection

LANCE A. NEUMANN, Ph.D.
President
Cambridge Systematics, Inc.

Topic Panel

ROBERT W. DRAPER, *Federal Highway Administration*
DAVID L. FLEMING, *Maryland Department of Transportation*
THOMAS W. HOWARD, *Federal Highway Administration*
ALVIN R. LUEDECKE, JR., *Texas Department of Transportation*
RICHARD PETRIE, *California Department of Transportation*
JAMES A. SCOTT, *Transportation Research Board*
KUMARES C. SINHA, *Purdue University*
MARK J. WOLFGRAM, *Wisconsin Department of Transportation*

Transportation Research Board
National Research Council

Research Sponsored by the American Association of State
Highway and Transportation Officials in Cooperation with the
Federal Highway Administration

NATIONAL ACADEMY PRESS
Washington, D.C. 1997

Subject Areas
Planning and Administration

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Research Council was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communication and cooperation with federal, state, and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

NOTE: The Transportation Research Board, the National Research Council, the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the individual states participating in the National Cooperative Highway Research Program do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

Project 20-5 FY 1995 (Topic 27-09)

ISSN 0547-5570

ISBN 0-309-6022-2

Library of Congress Catalog Card No. 97-67307

© 1997 Transportation Research Board

Price \$23.00

NOTICE

The project that is the subject of this report was a part of the National Cooperative Highway Research Program conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council. Such approval reflects the Governing Board's judgment that the program concerned is of national importance and appropriate with respect to both the purposes and resources of the National Research Council.

The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical committee according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

The National Research Council was established by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and of advising the Federal Government. The Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in the conduct of their services to the government, the public, and the scientific and engineering communities. It is administered jointly by both Academies and the Institute of Medicine. The National Academy of Engineering and the Institute of Medicine were established in 1964 and 1970, respectively, under the charter of the National Academy of Sciences.

The Transportation Research Board evolved in 1974 from the Highway Research Board, which was established in 1920. The TRB incorporates all former HRB activities and also performs additional functions under a broader scope involving all modes of transportation and the interactions of transportation with society.

Published reports of the

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

are available from:

Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

and can be ordered through the Internet at:

<http://www.nas.edu/trb/index.html>

Printed in the United States of America

PREFACE

A vast storehouse of information exists on nearly every subject of concern to highway administrators and engineers. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire community, the American Association of State Highway and Transportation Officials has, through the mechanism of the National Cooperative Highway Research Program, authorized the Transportation Research Board to undertake a continuing project to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

*By Staff
Transportation
Research Board*

This synthesis will be of interest to transportation department administrators, financial managers, program area managers, and others who are concerned with the financing, budgeting, and funding aspects of managing the transportation infrastructure. It will also be of interest to others outside of the DOT, including state legislators, metropolitan planning organizations (MPOs), local government officials, and environmental agencies who interact with the DOTs in programming and project development. The synthesis presents information on changes in the capital programming process instituted by DOTs in response to the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and to other factors that affect both policy and practice in developing and managing their capital program.

Administrators, engineers, and researchers are continually faced with highway problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to available practices for solving or alleviating the problem. In an effort to correct this situation, a continuing NCHRP project, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common highway problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCHRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific highway problems or sets of closely related problems.

In addition to the Intermodal Surface Transportation Efficiency Act (ISTEA), many states have enacted legislation that has affected the programming and project scheduling of state DOTs. This report of the Transportation Research Board describes key influences on programming, including federal, state, and local regulations, and the changes that have resulted. It also discusses programming and project selection methods used by the states, such as the criteria for setting priorities, use of management systems, tradeoff analyses, and public involvement. The key aspects of revenue forecasting and cash management as they relate to programming issues are also highlighted.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the Board analyzed available information assembled from numerous sources, including a large number of state highway and transportation departments. A topic panel of experts in the subject area was established to guide the research in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

CONTENTS

- 1 SUMMARY

- 3 CHAPTER ONE INTRODUCTION
 - Purpose and Objectives of the Synthesis, 3
 - Major Issues Confronting Programming and Project Scheduling, 3
 - Approach and Methodology, 4
 - Organization of the Synthesis, 4

- 5 CHAPTER TWO CAPITAL PROGRAMMING AND PROJECT SELECTION
 - Overview of Capital Programming, 5
 - Overall Objectives of Capital Programming, 5
 - The Key Elements of Capital Programming and Project Selection, 5

- 10 CHAPTER THREE KEY INFLUENCES ON PROGRAMMING
 - ISTEA Programming-Related Requirements, 10
 - State Legislation, 13
 - Environmental Regulations, 13
 - Financing Methods, 16
 - Uncertainties Affecting Program Decisions, 17

- 19 CHAPTER FOUR PROGRAMMING AND PROJECT SELECTION METHODS
 - Priority-Setting Tools, 19
 - Management Systems, 21
 - Program-Level Tradeoff Analysis, 24
 - Public Involvement, 25

- 29 CHAPTER FIVE FINANCING AND CASH MANAGEMENT
 - Revenue Forecasting, 29
 - Cash Management Methods, 30

- 32 CHAPTER SIX INNOVATIVE FINANCING APPROACHES
 - Range of Techniques, 32
 - Impact on Programming, 35

- 36 CHAPTER SEVEN CONCLUSIONS

- 39 REFERENCES

- 40 BIBLIOGRAPHY

41	GLOSSARY	
42	APPENDIX A	QUESTIONNAIRE
48	APPENDIX B	SURVEY RESPONDENTS
50	APPENDIX C	RESPONSES OF STATE DOTs TO SELECTED QUESTIONS
65	APPENDIX D	SUMMARY OF SELECTED STATES' PROGRAMMING PROCESSES
68	APPENDIX E	CASE STUDIES ALASKA DEPARTMENT OF TRANSPORTATION CALIFORNIA DEPARTMENT OF TRANSPORTATION FLORIDA DEPARTMENT OF TRANSPORTATION ILLINOIS DEPARTMENT OF TRANSPORTATION KANSAS DEPARTMENT OF TRANSPORTATION MICHIGAN DEPARTMENT OF TRANSPORTATION MINNESOTA DEPARTMENT OF TRANSPORTATION NEVADA DEPARTMENT OF TRANSPORTATION NEW YORK DEPARTMENT OF TRANSPORTATION PENNSYLVANIA DEPARTMENT OF TRANSPORTATION WASHINGTON DEPARTMENT OF TRANSPORTATION

ACKNOWLEDGMENTS

Lance A. Neumann, Ph.D., President, Cambridge Systematics, Inc., Cambridge, Massachusetts, was responsible for collection of the data and preparation of the report. He was assisted by Joanne R. Potter, also at Cambridge Systematics, Inc.

Valuable assistance in the preparation of this synthesis was provided by the Topic Panel, consisting of Robert W. Draper, Transportation Specialist, Federal Highway Administration; David L. Fleming, Manager, Financial Planning, Maryland Department of Transportation; Thomas W. Howard, Transportation Specialist, Federal Highway Administration; Alvin R. Luedecke, Jr., Director, Transportation Planning and Programming, Texas Department of Transportation; Richard Petrie, Chief of Federal Resources, California Department of Transportation; James A. Scott, Transportation Planner, Transportation Research Board; Kumares C. Sinha, Professor and Head, Transportation and Urban Engineering, Purdue University School of Engineering;

Mark J. Wolfgram, Chief of Program Analysis, Bureau of Program Management, Wisconsin Department of Transportation.

This study was managed by Sally D. Liff, Senior Program Officer, who worked with the consultant, the topic panel, and the Project 20-5 committee in the development and review of the report. Assistance in topic panel selection and project scope development was provided by Stephen F. Maher, P.E., Senior Program Officer. Linda S. Mason was responsible for editing and production, assisted by Beth Rosenfeld. Cheryl Keith assisted in meeting logistics and distribution of the questionnaire and draft reports.

Crawford F. Jencks, Manager, National Cooperative Highway Research Program, assisted the NCHRP 20-5 staff and the topic panel.

Information on current practice was provided by many highway and transportation agencies. Their cooperation and assistance are appreciated.

METHODS FOR CAPITAL PROGRAMMING AND PROJECT SELECTION

SUMMARY

Dramatic changes over the past 10 to 15 years have presented state transportation agencies with complex challenges to developing and managing their capital programs. These changes have included greater competition for public resources, changing roles of different levels of government, conflicting policy directions, availability of new approaches to financing, and demand for an increased accountability for effective management and maintenance of the transportation system. At the same time, the technical tools available to transportation agencies have changed considerably. The development of infrastructure management systems, improved economic analysis tools, and more accessible computer technologies have offered agencies an array of tools to use in making capital programming and project selection decisions. The Intermodal Surface Transportation Act of 1991 (ISTEA) reflected and reinforced these changes in the decision-making environment.

The ISTEA legislation envisioned a planning and programming process where long-range system plans at both the state and metropolitan levels provide the context and framework within which short-range programming decisions are made. The short-range state transportation improvement program (STIP) and metropolitan planning organization (MPO) transportation improvement program (TIP), both covering a 3-year period, represent the specific investment choices made to move toward the longer term policies and direction reflected in system plans. While ISTEA provided a vision for close coordination of system planning and programming and decision making at the metropolitan and state levels, in practice approaches to meeting this vision vary widely and a set of state and local legislation, institutional arrangements, and other factors, in addition to federal requirements, are reflected in the programming process of each state.

This synthesis study examined how state transportation agencies have responded to ISTEA and the other factors that influence the capital programming process in each state. The report provides a summary of the current state of practice among agencies and identifies issues that states have encountered in developing and managing their capital program, based on a review of relevant literature and a survey developed with the advice of the Topic Panel and distributed by the National Cooperative Highway Research Program. A total of 39 state agencies responded to this questionnaire.

The survey of state agencies identified several key aspects about how state transportation agencies are approaching the capital programming and project selection process. As might be expected, these approaches varied widely, and reflect the diversity of state geographic and demographic features, infrastructure conditions, financial resources, and organizational and political contexts within which state transportation agencies conduct their work. Specific conclusions reached through the study include the following observations:

- Stronger ties between policy and system planning and programming have been developed, particularly in the area of setting program goals and objectives, establishing performance measures or benchmarks and, in some cases, looking at broad multimodal tradeoffs at the system level.

- States are improving their ability to consider a wider range of transportation solutions and modal tradeoffs. However, significant barriers to multimodal programming exist. These barriers include institutional and funding constraints at the state level, continued differences in the administration of modal programs at the federal level, and continued need for more effective technical tools and data to support multimodal analysis within reasonable resource constraints.

- There is an increased emphasis on system preservation and management as reflected in program level tradeoffs and priorities and an increased use of asset management systems (especially pavement and bridge) to help define program level funding and set priorities for preservation-oriented investments.

- There has been an increase in the development and use of quantitative criteria for establishing goals and measuring performance. Awareness of the need to demonstrate more accountability is clearly increasing. More and more states are developing some type of annual report or performance report card to assess program delivery and the impact of investments on system performance. However, despite the progress, this development is neither as comprehensive nor as widespread as might be expected.

- Most agencies now have some management systems in place and are using them to track facility conditions. Pavement and bridge management systems are being used by about half the states surveyed to help set reconstruction and rehabilitation project priorities. However, the use of management systems as tools for more strategic decision making—such as setting program goals, measuring performance, and making investment tradeoffs among programs or modes—is not yet well developed. Additional steps are required to encourage more widespread use of management systems.

- Sufficiency and deficiency rating methods continue to be widely used to set priorities for a broad range of program areas. Benefit-cost techniques are primarily used for safety improvements; cost effectiveness or other rating factors are used by some states as well. While the extent to which quantitative methods are used for priority-setting varies considerably among the responding states, only two states did not report the use of any quantitative method at all. Several states noted their use of professional judgment and a range of qualitative factors in their prioritization process, often within the context of some statewide guidelines on needs and general program level priorities.

- Two states mentioned that they are moving toward a more decentralized approach to identifying projects and setting priorities based heavily on criteria and approaches developed at the sub-state level.

- The overall reaction to ISTEA programming related requirements was positive. The requirement for fiscally constrained programs was viewed as having the most significant, and generally positive, impact on programming. Fiscally constrained programming is increasingly resulting in states making key tradeoff decisions, developing more realistic short- and mid-term revenue projections, and focusing resources on the set of transportation needs that are most likely to be accomplished within an environment of constrained resources.

- There is an increasing level of awareness and interest among states in identifying new approaches to financing capital projects. States are aggressively experimenting with a wide range of methods of leveraging existing public revenues.

INTRODUCTION

PURPOSE AND OBJECTIVES OF THE SYNTHESIS

State transportation agencies face an increasingly complex task in the development and management of their capital programs. Over the past 10 to 15 years there have been dramatic changes both in the decision-making environment in which investment choices must be made, and in the decision support tools available to aid decision makers dealing with complex tradeoffs.

In terms of the decision-making environment, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) reflected a range of issues and concerns that increased in importance throughout the 1980s. These issues included greater competition for scarce funds and an ongoing "tax revolt" at all levels of government, demands for more accountability and stronger justification of the efficiency and effectiveness of public investments, more consideration of multimodal tradeoffs and greater funding flexibility to implement a range of solutions, an increasing emphasis on system management and maintenance, and changing roles of state, regional, and local agencies in making program and project decisions.

In terms of tools, new approaches to defining performance measures for transportation systems, continued development of infrastructure management systems, improved economic analysis approaches and the ever increasing power of micro-computer and client server technology have supported the development of new approaches to developing and delivering transportation capital programs and projects.

At the same time, it must be recognized that decisions on capital investment strategy and priorities are not simply, or even predominantly, technical decisions. A wide range of policy, political, and qualitative factors influence investment choices and must be recognized as the wide range of approaches to programming that exist at the state level are reviewed.

The rapid pace of these changes is continuing unabated as consideration of ISTEA reauthorization is underway. It is anticipated that significant changes in the direction of federal policies and funding levels are likely to be in place within 1 or 2 years. As the country moves into this next phase, it is useful to assess the impact of the major developments in policy and technology that have occurred over the past decade. The purpose of this synthesis, therefore, is to examine how state departments of transportation (DOTs) have responded to these changes. This synthesis provides a summary of the current state of practice, identifies the range of strategies that have been developed by state transportation agencies to develop and manage their capital program, and highlights the issues that states have encountered as they seek to take advantage of new technologies and to accommodate an increasingly dynamic decision-making environment.

MAJOR ISSUES CONFRONTING PROGRAMMING AND PROJECT SCHEDULING

A number of key issues are confronting transportation decision makers and must be reflected in the programming process. While the exact nature of these issues, and the appropriate response, varies from state to state, they reflect the complexity of the decision-making environment within which programming decisions must be made. These issues include:

- **Broad and Often Conflicting Policy Direction**—Most states have some type of formal or informal statement of transportation policy goals and objectives. These policies generally recognize that transportation is one means to achieving broad social, economic, and environmental goals and not an end in itself. Translating these broad goals into action is a key challenge of the transportation planning and programming process. The fact that the appropriate balance among often conflicting goals, or the appropriate transportation actions to achieve goals, may vary from region to region within a state and that local jurisdictions may have very different goals adds to the challenge of shaping transportation programs. Recent changes to strengthen long-range statewide and metropolitan system planning provides an important opportunity to strengthen the connection between planning and programming and provide more guidance and direction to shorter-range investment programs. However, no matter how the connection is made, clearly linking transportation programs to the achievement of broader goals and using the planning and programming process to reconcile and balance different goals is likely to be important to maintaining broad public support.

- **Competition for Resources**—Competition for scarce public resources for transportation has probably never been greater at a time when the demands on those resources, in terms of the range of improvements being considered, have grown as well. More rigorous evaluation and justification of all expenditures is required and the assumption that certain types of transportation investments are inherently good is simply no longer accepted. Skepticism about the role and effectiveness of government programs is evident at every level of government, and there is increasing pressure on states to develop and communicate a strong case for investment decisions.

- **Accountability and Performance**—Together with the increasing competition for public resources is the demand that transportation agencies and programs be held accountable for results by measuring and reporting the impacts and outcomes of transportation investments. Statistics on the size of the program, the number of projects, or amount of work of various types accomplished, while useful descriptors of activity levels, do not meet this need. Information about the impact on service levels, facility conditions over time, and the connection to

broader goals is required. The demand for more accountability is also motivating a number of transportation agencies to examine how programs and projects are delivered and how total quality principles can be applied in the public sector.

- **Public and Private Roles and Financing**—In response to the difficulty of increasing public sector funding in the current political climate, a wide range of innovative financing and cash management approaches, such as state infrastructure banks (SIBs), are being introduced to leverage or expand existing revenue sources. In addition, privatization and outsourcing are redefining private and public roles in many areas and this trend is likely to increase.

- **Institutional Arrangements**—The number of agencies and groups involved in the planning and programming process has continued to increase and the roles played by various actors has shifted. ISTEA strengthened the role of metropolitan planning organizations (MPOs) in the programming process and encouraged broader participation of various interests and groups through public participation efforts and by establishing programs like the enhancement program that made a wide range of nontraditional types of projects eligible for funding. Similarly, at least at the planning stage, a greater emphasis was placed on looking at all modes and at freight as well as passenger issues.

- **Emphasis on Preservation and Management**—Consistent with many of the issues identified above, and particularly the competition for scarce resources, an increasing emphasis is being placed on system preservation and management. Both these trends are a logical outgrowth of the search for ways to leverage existing resources and maximize benefits to the users of the system. Preservation of the system and protection of the investment in existing facilities is a top priority in most, if not all states. This focus has encouraged continued development of facility management systems (i.e., pavement, bridge, maintenance and public transit) and life-cycle cost approaches even as the mandatory requirements have been made optional. In addition, operational improvements and new technology initiatives, most notably intelligent transportation systems (ITS), have been designed to realize the best service levels possible with the existing fixed facilities.

- **Uncertainties**—Some degree of uncertainty in funding levels and sources, project budgets and schedules, and policy directions of new administrations are a fact of life in developing and managing transportation programs. How these factors are anticipated and responded to ultimately has an impact on the effectiveness of the program and the ability to focus resources on priority needs. In addition, transportation systems and services can be disrupted by a variety of natural disasters that require an immediate response and commitment of resources. A range of quantitative approaches can be used to assess the factors that create risk and vulnerability.

All of these issues and others are affecting how states are developing and managing their investment programs. While

no one approach is appropriate for all states, there may be elements in one state's approach that are useful to others. The purpose of this synthesis is to provide such a resource.

APPROACH AND METHODOLOGY

The synthesis study had two key elements: a survey of state departments of transportation, and a literature review on capital programming approaches and techniques. The survey, which is included in Appendix A, was distributed in 1996 to 52 departments of transportation, which included all 50 states, Puerto Rico and the District of Columbia. A total of 39 responses were received (see Table 1).

TABLE 1
STATE DEPARTMENT OF TRANSPORTATION SURVEY
RESPONDENTS

Alabama	Kentucky	Oklahoma
Alaska	Maryland	Pennsylvania
Arizona	Michigan	Puerto Rico
Arkansas	Minnesota	South Carolina
California	Mississippi	South Dakota
Connecticut	Missouri	Texas
Delaware	Montana	Utah
Florida	Nebraska	Vermont
Georgia	Nevada	Virginia
Hawaii	New Jersey	Washington
Illinois	New York	West Virginia
Iowa	North Carolina	Wisconsin
Kansas	North Dakota	Wyoming

ORGANIZATION OF THE SYNTHESIS

An overview of the basic components of the capital programming and project selection process as undertaken by state departments of transportation is presented in chapter 2. The following four chapters summarize the current state of practice by DOTs. Chapter 3 reviews states' responses to five key influences on programming and discusses the level of impact each of these factors has had on various states. Chapter 4 provides an overview of programming and project selection methods currently in use by DOTs and discusses the major issues and barriers that states identified in developing effective capital programming methods. Chapter 5 presents the financing and cash management techniques used by DOTs to manage revenue forecasting for state and federal funds and to optimize cash flow. Chapter 6 summarizes the range of financing innovations that have been developed by states—both prior to and in response to ISTEA legislation and reductions in federal funding. Chapter 7 presents conclusions based on the synthesis study findings.

CAPITAL PROGRAMMING AND PROJECT SELECTION

OVERVIEW OF CAPITAL PROGRAMMING

This section provides an overview of the programming function and of the programming process as it occurs in state DOTs. The description included here is meant to provide a common framework for reviewing programming practice, not to prescribe how it should be done in every state. In fact, the approach to programming varies widely from state to state in response to a range of institutional, political, and financial factors; no one approach would be appropriate for all, or even most states. The framework here builds on earlier work of the author and others. (1)

OVERALL OBJECTIVES OF CAPITAL PROGRAMMING

There are three key objectives of the capital programming and project selection process. These objectives are:

- Effective allocation of resources to address policy objectives;
- Facilitating tradeoffs among competing investment opportunities; and
- Supporting efficient program and project delivery.

Effective Allocation Of Resources To Address Policy Objectives

One of the major objectives of programming is to ensure that resources are allocated effectively. There are two aspects to this. First, an effective capital programming process enables decision makers to know whether the various policy objectives and priorities that have been defined are being addressed. Given that the program is indeed responsive to policy, the second key issue is whether funds are being spent wisely: are the specific types of projects in the program the most cost-effective way of solving problems or meeting identified needs, and are the projects in the program justifiable from a benefit-cost standpoint? In addition, an equitable allocation of resources to different regions and types of needs and user groups as well as other policy issues must also be considered.

Facilitating Tradeoffs

While programming is sometimes viewed primarily as a technical exercise, it is in reality a key part of a political decision-making process that involves transportation engineers and planners on the one hand, and legislative or governmental bodies on the other. Therefore, a programming process should

not be judged by its end results alone, but also by how the process itself is structured and by the information it provides for making key resource allocation decisions. An important objective of a programming process is to assist both technical and policy decision makers by presenting options and clarifying cost-benefit tradeoffs among the various options. Often, this process of considering choices and tradeoffs begins with an emphasis on technical information but ultimately reflects many policy and political factors as final choices are made.

Supporting Efficient Program and Project Delivery

Assuming that the right allocation of funds is made, and the "best" projects are selected, there are two additional yardsticks by which a program can be measured. First is the extent to which the program is realistic in the sense that it can be delivered in the proposed timeframe and for the proposed budget. Second is whether the program is constructed to realize efficiencies by coordinating projects and scheduling of available resources, or at least to not preclude achieving these efficiencies in project scheduling and contracting procedures. In addition, effective delivery requires anticipating that some adjustments to project costs and schedules will need to be dealt with during implementation.

THE KEY ELEMENTS OF CAPITAL PROGRAMMING AND PROJECT SELECTION

Figure 1 illustrates a transportation agency's programming process. There are a variety of approaches to capital programming and project selection in different states, at different governmental levels, and for different modes. These approaches reflect different political and institutional environments, funding sources and financing mechanisms, agency capability and management styles. No one approach is correct or appropriate for all states. Nevertheless, there are common elements or activities that are normally part of a successful programming process. These key elements of capital programming are described in the following sections. Table 2 summarizes the main activity involved in each of these elements.

Setting Program Goals and Objectives

The first step in an effective capital programming process is the development of explicit program goals and objectives

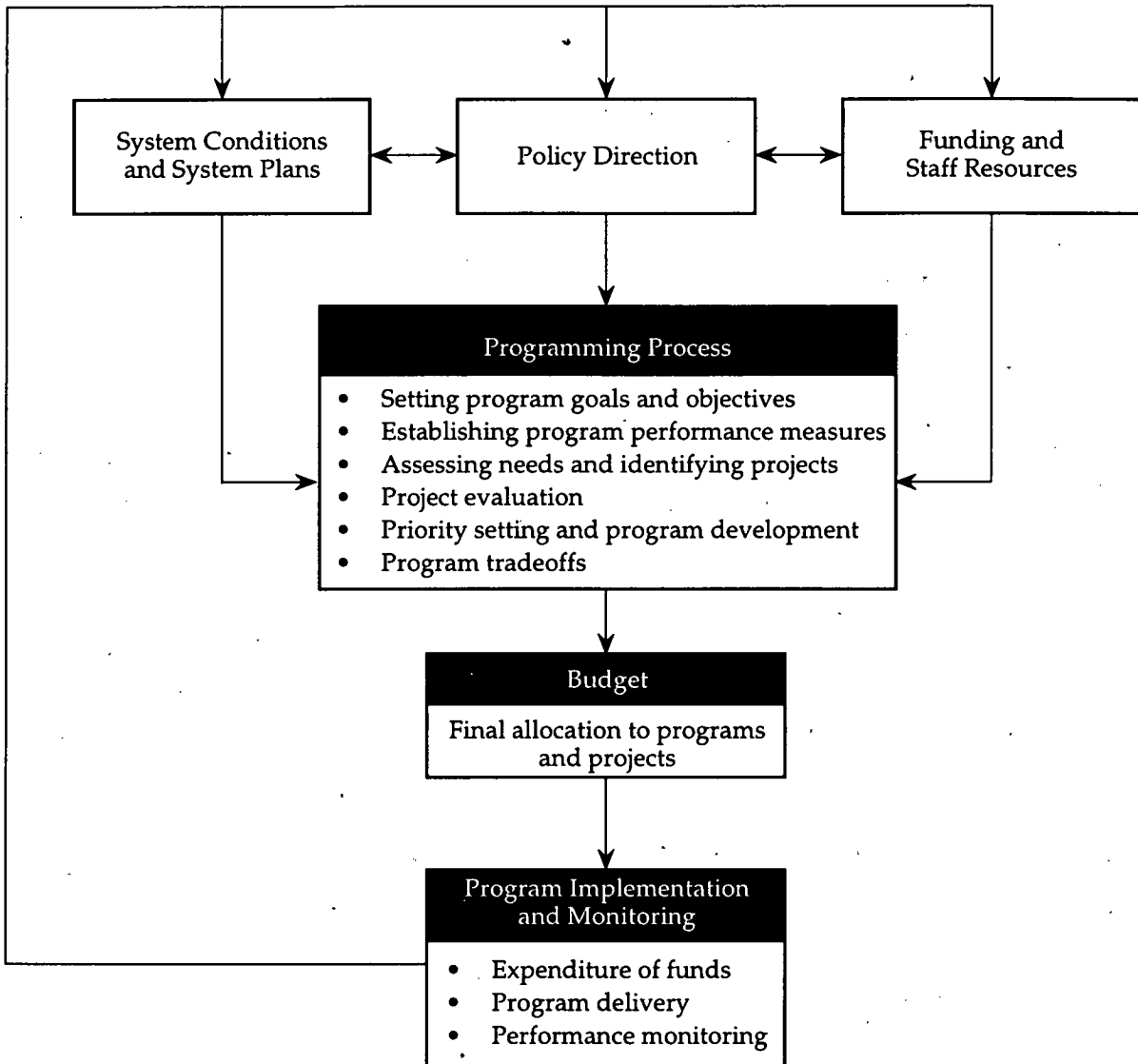


FIGURE 1 Overview of capital programming process.

that will enable the transportation agency to implement its core policy objectives. Indeed, successfully translating policy into action is the key challenge of the planning and programming process. Goals and objectives are used to provide specific direction and guidance to the organization on its strategy for achieving targeted improvements in the transportation system. They also provide the basis of accountability to the agency's customers and investors. Goals and objectives are informed by a variety of factors, including the overall condition and needs of the statewide transportation system, state and local objectives for economic development and land use, environmental concerns, financial resources, direction from regional planning organizations, and input from business and interest groups, policy makers, and the general public.

The purpose of this step is to develop measurable service objectives related to each policy priority in order to provide direct and specific guidance to the programming process. Clear goals and objectives provide a basis for defining performance

measures, assessing needs, identifying candidate projects, and evaluating projects and programs for investment.

The ISTEA legislation has expanded the planning universe of most DOTs—whose historic mandate had been confined to the development and maintenance of road and bridge facilities. ISTEA's focus on multimodal approaches to transportation solutions, and on freight as well as passenger movement, has required DOTs to work toward developing comprehensive intermodal plans for an effective statewide transportation system. The major investment study (MIS) requirement is one tool to encourage that broader approach. This usually has required changes in the level of interagency coordination necessary with other state and local agencies. Perhaps even more significant, this intermodal approach has propelled a fundamental shift in the way in which goals and objectives are structured and defined by focusing on issues such as mobility, congestion reduction, and environmental quality, as well as safety and system preservation.

TABLE 2
KEY ELEMENTS OF THE CAPITAL PROGRAMMING AND PROJECT SELECTION PROCESS

Key Element	Purpose/Main Activity
Setting Program Goals and Objectives	<ul style="list-style-type: none"> Establish clear and measurable statements of what the transportation agency wants to accomplish to meet its policy goals consistent with the state transportation plan
Establishing Program Performance Measures	<ul style="list-style-type: none"> Set criteria to enable the agency to measure the progress of program implementation and to evaluate the results of its program in terms of system performance, costs, and benefits
Assessing Needs and Identifying Projects	<ul style="list-style-type: none"> Identify and measure deficiencies, problems, and needs Identify alternative solutions to address these needs Develop candidate projects
Project Evaluation	<ul style="list-style-type: none"> Evaluate proposed projects according to consistent criteria
Priority Setting and Program Development	<ul style="list-style-type: none"> Organize the agency's work into program areas reflecting distinct objectives and/or types of work Identify priorities for each program area consistent with agency goals and objectives Set priorities for projects within (or across) each program area using criteria which reflect agency goals and objectives Develop fiscally constrained candidate programs reflecting realistic project budgets and schedules
Program Tradeoffs	<ul style="list-style-type: none"> Evaluate what the proposed program will achieve Evaluate tradeoffs for shifting resources among program areas or project types (e.g., bridge rehabilitation vs. capacity expansion) Determine levels of resource allocation across program areas based on agency priorities including the results of needs analysis
Budgeting	<ul style="list-style-type: none"> Develop expenditure plan based on available resources and project and program costs
Program Implementation and Monitoring	<ul style="list-style-type: none"> Implement program Monitor progress in program delivery Track system conditions and performance over time Evaluate results based on established performance measures

Establishing Program Performance Measures

The purpose of establishing program performance measures is to enable agency managers to assess the degree to which the selected investment program has been successful in terms of improved system performance, cost, and benefits. In addition, program delivery performance measures are established to evaluate the effectiveness of the agency's program delivery system by each stage of project delivery: from planning to design and construction. The specific performance measures selected will be unique to the circumstances of each state, including that state's infrastructure condition, resource base, and policy focus. Whatever performance measures are selected, the process of setting clear standards for performance and using the results of this evaluation to inform future investment choices and management decisions is essential to ensure that an agency's investment of resources is producing the intended outcomes.

System performance measures include measurement of targeted improvements in mobility, accessibility, user cost, infrastructure conditions, environmental quality, safety, and other factors.

Program delivery performance measures include measures of the efficiency and the effectiveness of each stage of the capital project and program delivery process. These include measures of the duration and cost of project phases, number of design changes or construction change orders, comparison of total cost and schedule to program and budget targets, and productivity measures related to the volume and unit cost of work accomplished.

Assessing Needs and Identifying Projects

Most agencies have established procedures for identifying deficiencies, needs, and candidate projects. Although this

activity typically falls within the planning (rather than programming) function, it is critical to the programming process as the source of basic inputs. Needs estimates and project identification are done through a combination of methods:

- Results of statewide and MPO system and corridor planning efforts;
- Facility management systems;
- Facility inventory and inspections;
- Review of accident, traffic or ridership statistics, and vehicle or equipment breakdowns;
- Sufficiency ratings or deficiency threshold criteria;
- Outcome-based performance measures; and
- Suggestions by agency staff, elected officials, and citizens.

Needs estimates have traditionally been based on existing physical and service operating conditions compared to a set of design and service standards. However, in many cases, these standards have not been developed on the basis of traveler preferences or economic feasibility. A more logical approach is to determine appropriate standards according to the public's willingness to pay. The advantage of such an approach is that it can be related to finance and taxation policies in a state, region, or local jurisdiction.

After needs are identified, specific projects can be developed for consideration in the project evaluation and priority setting phases of program development. In some states, and for some types of projects (typically more major system enhancement or expansion improvements), a concept development or preliminary engineering phase of project development activity is funded before a specific project concept is recommended for programming. In others, a level of improvement concept is established as a framework for more detailed project development activities. In some instances, alternative projects for addressing a particular need or problem may be defined, however, frequently only one option is developed (particularly for preservation and minor improvement type projects). However structured, the project identification and development activity must define the appropriate type and levels of improvement (including mode, capital or operating or policy solution, etc.) for a particular need and the proposed cost, schedule and, in some cases, financing options.

Project Evaluation

A key program development activity is to evaluate each candidate project to provide a basis for deciding which projects should be funded. There are a number of methods of project evaluation, ranging from informal and qualitative to highly complex and technical. In some instances, priorities are based on the judgment of elected officials and/or engineers. Many agencies develop project ranking methods that consider either the severity of the problem to be solved or the estimated benefit or impact of the candidate project. Some do a more formal cost-effectiveness or cost-benefit analysis. Optimization methods have also been used to assist in project selection, particularly for pavement and bridge preservation projects.

Ranking or optimization methods can be geared toward individual categories of projects or may allow for analysis and comparison of very different types of projects. Cost-effectiveness, cost-benefit, and optimization methods all offer an approach to examine, in a more rigorous and analytic way, the best use of resources. For example, such methods can assist in determining the budget level required to maintain physical assets at a desired level of condition or alternatively, the condition level that can be achieved for a given budget amount.

Priority Setting and Program Development

The development of a simple overall program structure for organizing the agency's work can facilitate the connection between policy objectives and specific project activities. Organizing projects and initiatives into logical categories, such as project type, policy objective, and scale, allows for competition for funds among alternative service and system improvements while ensuring that the appropriate overall focus of investments is maintained. For example, a program structure might organize projects in preservation, management/efficiency, and capacity expansion.

The objectives of a structure for program-level analysis are to:

- Provide a focus for policy and strategic direction;
- Establish priorities and problem/project thresholds by category;
- Provide a structure for resource allocation; and
- Communicate agency focus, investment choices, and performance to internal and external constituencies.

Program Tradeoffs

The objective of program evaluation is to develop the most cost-effective mix of projects within a specific program category and to examine the implications of shifting funds between categories. Generally the project priority-setting and program development and evaluation steps must occur together to avoid the tendency to rank a set of predefined projects independent of the resource constraints and simply pick from the top of the list until funds are used up. Such an approach usually does not result in the best mix of projects. In other words, the appropriate level of investment in a particular project will generally depend on the merits of that project, the alternative projects competing for funds, and the overall size of the budget.

In an era with a well-defined and rigid program structure and with little flexibility to shift funds, the lack of attention to explicit program evaluation and examination of tradeoffs between categories within a mode, between modes, and between jurisdictional levels was understandable. The introduction of ISTEA created a new era where many complex choices now confront decision makers. Explicit evaluation of program-level tradeoffs are key to defining the implications of these choices.

A number of analytic approaches are possible to support program evaluation and tradeoffs. For example, economic analysis and optimization approaches have been developed for some facility management systems and capital improvement project applications. In other cases, a multicriteria summary of program impacts—incorporating both quantitative and qualitative criteria—is the more practical and effective approach. The key objective for any of these methods is to summarize the impacts (both positive and negative) of shifting funds from one program category to another. As discussed earlier, where most analytic approaches are acceptable, benefit-cost and optimization techniques can assess the economic benefits and costs of such shifts or define the service level possible at different program funding levels.

Whatever approach is used, evaluation criteria are most useful when they directly reflect the policy directions established for transportation and the criteria used to define long-range system planning objectives. Furthermore, evaluation criteria must be “mode neutral” if multimodal solutions are to be fairly considered.

Budgeting

The process of establishing a budget—while never a simple exercise of adding up project costs and adjusting expenditures to match available funds—has become even more complex due to some increased flexibility in federal funding, the availability of new sources of financing from local and private sources for particular initiatives, uncertainty about future levels of public funding, and a shift in emphasis from large capital projects to investment in existing facilities. These factors have increased the importance of viewing budgeting as an iterative process, in which the final budget is set only when program priorities and tradeoffs have been evaluated.

Establishing target resource allocations by program level at the beginning of the programming cycle can help guide the project evaluation process and ensure that agency priorities will be emphasized through the distribution of funds. Some portion of funds available will be allocated by mode, program

category, and geographic region at the start of the programming process. A full assessment of project and program-level tradeoffs takes place prior to final fund allocations if the potential benefit of funding flexibility is to be realized.

Ultimately, of course, budget decisions will reflect a broad range of policy, political, and qualitative factors as well. In fact, the technical information provided to the budgeting process is meant to inform these inherently political choices, not make them.

Program Implementation and Monitoring

Monitoring the progress of program implementation and the results of the program measured by system performance, costs, and benefits provides an important feedback loop into both the technical assumptions made in the process and the policy decisions regarding priorities, strategies, and emphasis areas. A solid monitoring program can, over time, improve the effectiveness of the programming process and enhance its credibility by establishing better accountability for program decisions and by providing feedback to policy makers whose understanding and support of the transportation program is critical to its success. The criteria used to monitor system performance can reinforce consistency and integration between planning and programming when they are directly related to the transportation policy goals of the agency as defined in statute, policy plans, and system plans.

Again, it is important to emphasize that the description of the key elements in the programming process provided here is not meant to imply that there is one right way to structure the process or make critical resource allocation decisions. From state to state, institutional arrangements, responsibility for the programming function within the DOT, the degree of decentralization of decision making, approaches for including a wide range of stakeholders in the process, policies, and state statutes vary widely. As a result, the approaches states take to deal with each element of the programming process vary as well. There is no one correct approach. There is no one approach appropriate for all states.

KEY INFLUENCES ON PROGRAMMING

State transportation agencies must respond to a variety of factors as they develop their programs. The survey asked states to describe the type of impacts these factors have on their programming process, and the degree to which they have changed or influenced the way in which DOTs approach programming and project selection. The factors are discussed in this chapter.

ISTEA PROGRAMMING RELATED REQUIREMENTS

Agencies varied considerably in their perception of the impact of ISTEA requirements on their programming and project selection processes. As might be anticipated, much of this variation is linked to the transportation agency's programming practices prior to ISTEA and the degree to which ISTEA requirements meshed with—or required restructuring of—their former approach. Five major ISTEA requirements were examined:

- Financially constrained State Transportation Improvement Program (STIP)/Transportation Improvement Program (TIP);
- Funding flexibility;
- Expanded role for MPOs in programming;
- Integration of STIP/TIP documents; and
- ISTEA planning factors.

As illustrated in Table 3, more than half of the respondents found that the requirement of financial constraint has had the most significant influence on programming. It should be noted that for states that had financially constrained programs prior to ISTEA, the ISTEA requirement did not have an impact.

ISTEA's funding flexibility was rated as second most influential, and there was a wide range of opinions about the complexity and utility of this aspect of the legislation. The degree to which the expanded role of MPOs was considered to have had a significant impact generally varied according to the DOT's previous experience in working with MPOs and the MPO's level of technical sophistication in programming and project selection. In addition, some states have few or no MPOs to deal with. While many agencies complained about the administrative and technical burden of integrating STIP and TIP documents, this requirement was usually deemed to have had less influence on the agency's programming activity than other ISTEA provisions. Finally, the ISTEA planning factors represented issues that had to be reflected in long-range system plans and were viewed as having little direct influence on programming. Another synthesis report evaluated DOT and MPO experience with these factors. (2)

The survey findings related to each of these factors are discussed in further detail below.

Financially Constrained STIP/TIP

Twenty respondents reported that the requirement for financially constrained STIPs and TIPs was the ISTEA programming change that had the most significant effect on their programming and project selection. Some of these agencies complained that this requirement is unnecessarily restrictive, requires excessive documentation, and impedes their ability to respond efficiently to changes in project schedules and costs. Many agencies noted that a mechanism to allow for some "overprogramming" or a contingency list was required. The lack of such a mechanism made it difficult to deal quickly and efficiently with changes to project costs and schedules or the

TABLE 3
INFLUENCE OF ISTEA REQUIREMENTS ON STATE DOT CAPITAL PROGRAMMING

ISTEA Requirements	Total Responses	Average Rating	Level of Influence				
			Most 1	2	3	4	Least 5
Financially constrained STIP/TIP	39	2.33	20	4	3	6	6
% of respondents			52	10	8	15	15
Funding flexibility	39	2.51	10	10	9	9	1
% of respondents			26	26	23	23	2
Expanded MPO role	39	2.95	5	13	6	9	6
% of respondents			14	33	15	23	15
Integration of STIP/TIP documents	38	3.00	4	11	9	9	5
% of respondents			10	29	24	24	13
ISTEA planning factors	37	3.76	2	3	12	5	15
% of respondents			5	8	32	14	41

inability of an implementing agency (state, MPO, local) to deliver on projects or use all the funds allocated to them. The STIP/TIP amendment process was not viewed as an effective approach to dealing with routine project changes.

Another agency suggested making the requirement less restrictive by looking at the total funding level across all programs rather than on a program-by-program basis.

This is gradually, year by year, becoming a bigger problem for this state. Locally, the Division Office of FHWA is trying to help, but they are limited by statute, regulation, and their interpretations of the regulations. WSDOT, transit and the counties/cities are slowly being squeezed to a "realistic" program of projects in the STIP. This has made summing up the programs to the STIP more difficult, as not all the MPOs recognize or practice fiscal constraint in their programming. Not being allowed to use the unobligated balances of previous years' apportionments as available federal revenue for the entire state made it difficult to develop a fiscally constrained STIP.

—Washington State Department of Transportation

A number of DOTs voiced a different perspective, however. They commented that while this requirement had a significant impact, the result was a marked improvement in their programming process. These respondents noted that the requirement to submit a financially constrained STIP/TIP has produced a better and more rigorous level of fiscal management and the motivation to make "serious choices" at both the state and MPO levels. Hawaii noted that the requirement has forced a new level of fiscal management on their transportation projects. Oklahoma considered the requirement of fiscal constraint to be "one of the best benefits derived from ISTEA." Another state noted that the requirement was creating pressure to improve the method used to estimate project schedules and costs.

Agencies that did not believe this requirement had a significant impact generally reported that they had already been working within a state requirement of fiscal constraint. These included DOTs in Florida, Illinois, North Carolina, and South Dakota.

Funding Flexibility

ISTEA provided increased funding flexibility by both broadening the range of transportation solutions that could be funded and allowing resources to be shifted among funding programs. Twenty of the 38 respondents (52 percent) rated increased fund flexibility as the ISTEA change that was the first or second most significant influence on programming—although opinions about the nature of this influence ran the gamut. Agencies that were in a position to take advantage of the new flexibility praised this feature of ISTEA and were able to direct more resources to priority needs. Where a lack of total funds, state legislative commitment to an existing ongoing program, or significant current needs in each program category did not allow exploiting any funding flexibility, agencies perceived no benefit from this aspect of ISTEA.

Nine DOTs specifically lauded the increased flexibility provided by ISTEA, noting that they are more able to meet state needs by redirecting federal dollars. For example, Maryland

commented that this flexibility "Allow[s] the State to address actual needs rather than spending money in specific areas, even though we are limited to a certain degree."

Flexibility allows a total, needs-based funding approach. Projects and programs are evaluated and prioritized first; funding categories are matched to those priorities later.

—New Jersey Department of Transportation

The most significant funding flexibility change has been innovative financing techniques. However, this change has not provided additional funding that is significant, rather the opportunity for greater participation from a broader range of participants.

—Nebraska Department of Roads

In contrast, 12 agencies regarded ISTEA's "flexibility" as less than ideal, citing the restrictions caused by multiple sub-allocations and the difficulty of actually transferring funds without an increase in total dollars. Several agencies noted that the availability of insufficient funds overall means that they must apply funds to meet a backlog of unmet needs for conditions improvements. This means that ISTEA's funding flexibility, while useful in theory, has little actual utility. South Carolina DOT noted that the state now faces increased demands on transportation dollars without an increase in the funds available. While not directly related to ISTEA's funding flexibility provisions, Delaware, Michigan, Utah, and Oklahoma were among the DOTs that identified a problem in managing an excessive number of funding categories.

Another factor affecting agencies' reaction to this feature of ISTEA was existing state legislation defining how flexibly state funds can be used. In the case of California, ISTEA made it easier for the agency to take advantage of already existing fund flexibility at the state level. For other agencies, restriction on use of state funds constrained the DOT's ability to use ISTEA funding flexibility.

The ability to program and schedule projects was not a problem based on the Federal apportionments Oklahoma received. However, we failed to see any significant flexibility in the funding. The "BR" program remained the same as in past years, the National Highway System replaced the consolidated primary with little or no actual change in funding flexibility, and the Interstate 3R program was replaced with a much more restricted Interstate Maintenance program. The biggest problem with the "IM" funds was the inability to use these funds for lane additions. The STP program was the most flexible, but the funds were sub-allocated into nine categories with limitations on how these funds could be used.

—Oklahoma Department of Transportation

Expanded Role for MPOs in Programming

Despite the debate and, in some cases, controversy that this provision of ISTEA generated, most agencies rated this aspect of ISTEA as having less of an impact than either the financial

constraint or funding flexibility provisions. The specific reactions varied and reflected each agency's previous relationship with MPOs as well as the capability of the MPOs themselves. For example, both New York and California specifically noted that their decentralized process already placed a large amount of responsibility and control at the MPO level. Other DOTs, such as Illinois and Minnesota, which had been working closely with MPOs on project selection prior to ISTEA, believed this requirement had a big impact on programming.

For many years, metropolitan planning organizations (MPOs) in Florida have had a significant role in programming and project selection. Even prior to ISTEA the Florida Department of Transportation (FDOT) used MPOs' priority listings as the basis of the development of the Department's Adopted Five Year Work Program. However, since the passage of ISTEA, the MPOs have expanded their influence in choosing and prioritizing projects utilizing federal Surface Transportation Program (STP) funds applicable to their geographic areas. For example, Transportation Management Areas (TMAs) have much greater influence than before ISTEA. Non-TMAs operate under the previously existing system that ensures close coordination with FDOT.

—Florida Department of Transportation

MPOs have taken a more active role in programming projects within their Regions. Regional planning organizations have initiated corridor and access management studies within their regions from which recommended future projects address regional priorities.

—Connecticut Department of Transportation

However, a number of agencies clearly believed that ISTEA got the MPOs more involved in programming with a positive result. The DOT/MPO relationship became closer and more open and better projects with stronger support were selected within MPO areas as a result. For some agencies, this increased involvement required more coordination and resources devoted to project selection within MPO boundaries and lengthened the time required to develop a program. Other agencies expressed concern about the ability of some MPOs to play a stronger role in financial analysis, priority setting, and coordinating project delivery by member jurisdictions in order to deliver the program. However, some recent studies have also suggested that some MPOs have had a difficult time getting the financial and project information necessary for them to play an expanded role.

This expanded role, applicable to MPOs of over 200,000 population, has necessitated a closer working relationship in integrating MHTD's program of project improvements into development of the MPO Transportation Improvement Program. It has also brought about a more open process with improved public participation.

Having the MPOs helps to get the best type of transportation projects constructed within the MPO boundary. In general, I believe the MPO planning process has helped MHTD see the need for this type of planning in all areas of the state.

... Missouri has a positive working relationship with all of our MPOs. MHTD has just entered into a Memorandum of

Understanding with East-West Gateway (St. Louis Area) to jointly determine programming decisions through the use of shared staff.

—Missouri Highway and Transportation Department

Integration of STIP/TIP Documents

Overall, DOTs rated the requirement for an integrated STIP and MPO TIP document as having about as significant an impact as the changes to the MPO role. However, while the MPO changes received quite a few positive reactions, the requirement for an integrated STIP/TIP document was seen primarily as adding cost and effort with questionable added value.

Minnesota DOT praised the requirement and believed it created the first comprehensive document of all federal and state projects. Many others saw the requirement as primarily an "editorial matter" and, while not having any significant impact, also not taking significant resources. For many other agencies, the integration created a significant administrative burden. Specific issues identified included developing a common format that met all federal, state, and MPO needs; reconciling project databases and software; and developing consistent reporting conventions and planning schedules where federal, state, and MPO planning cycles and fiscal years do not coincide. One agency also mentioned the amendment process required for the STIP/TIP due to project changes as cumbersome.

While a recurring theme seemed to be additional administrative burden with little perceived benefit, there was also a sense that some of these issues might be lessened as new procedures, formats, and databases are developed.

ISTEA Planning Factors

Fifteen respondents (41 percent) reported that this requirement has had the least impact on their programming process; most others (46 percent) found it of only moderate influence. Ten agencies noted that most of the ISTEA planning factors had already been incorporated in their program plans prior to ISTEA. A few DOTs, such as Connecticut, Florida, and Washington, noted that the factors had generated changes in the inclusion of multimodal categories within their programs.

Several agencies commented that the ISTEA planning factors have been more relevant to their long-range planning process than directly to their programming process. One DOT specifically commented that the influence of these factors was not significant because they had no evaluation process to measure agency performance on the factors.

The overall response indicated that the planning factors are generally not reflected directly in the programming process of most state DOTs. This lack of a strong connection between planning objectives and programming may make it harder for agencies to evaluate the effectiveness of their programming choices and the overall success of their programs with respect to these factors. As noted earlier, another synthesis report has evaluated the influence of these factors. (2)

STATE LEGISLATION

The survey specifically asked DOTs whether any recent state legislation had a significant impact on programming and the responses only reflect recent legislative actions. However, in many, if not most states, statutes that have been in place for many years shape and influence the programming process. These statutes often define state funding categories, fund allocation methods, and priority and performance factors.

Twenty of the responding agencies (51 percent) reported that there had been recent changes to state legislation that had significantly impacted their program development process; 19 had experienced no legislative activity related to capital programming. Of those who reported relevant legislative activity, three agencies reported legislation related to facility standards, including pavement guidelines (Hawaii) and rail crossing safety (South Dakota). Nebraska's legislature approved a mandatory annual Highway Needs Study. Other legislation involved agency reorganization or revisions in the programming process requirements. Wyoming reported that their legislature created a new Department of Transportation, incorporating the former Highway Department and other transportation agencies.

Not surprisingly, most legislative activity related to resource development, allocation, or management. Six agencies reported legislation to expand revenues; these actions ranged from increases in fuel taxes to approval of major multiyear capital programs. Measures taken by states to increase revenues are discussed further in chapter 6. Only two agencies, Connecticut and Wyoming, reported legislative activity that reduced state revenues available to the transportation agency. Both Michigan and California noted legislative changes that influenced the allocation of funds to particular program areas. In California, legislation was passed to make state funding categories and other requirements consistent with ISTEA.

In terms of financial management both Vermont and Kentucky reported an increase in legislative oversight of project and program costs, and New Jersey reported a provision to allow multiyear funding of major projects. In terms of the programming process itself, Washington passed legislation to change the program structure and place greater emphasis on project and program performance evaluation and use of benefit-cost procedures. Delaware reported legislation requiring the establishment of more formal priority-setting criteria and processes (see Table 4).

ENVIRONMENTAL REGULATIONS

As might be anticipated, the survey results indicate that environmental regulations are having a significant impact on programming and project selection. The nature and degree of that impact vary widely from state to state depending on a range of natural and climatic factors. Only two agencies, North Dakota and South Dakota, reported little or no impact from any of the four environmental regulations identified in the questionnaire: air quality, noise, wetlands, and water quality. More than 60 percent of agencies reported an impact on

both scheduling and project cost due to environmental requirements. Arkansas, for example, estimated that "environmental handling" can add 6 to 12 months in project development time, and noted that costs related to mitigation directly affect funding availability for construction. States with well developed state environmental regulations sometimes reported that negotiating differences between state and federal requirements seriously complicated the review and approval process (see Table 5).

The type and level of impact differs, logically, based on the environmental profile of each state; for example, more densely populated and urbanized states find air quality regulations significant while for rural states with full attainment status this is not a significant issue at this time. However, the degree to which agencies facing similar issues have developed strategies to manage these environmental requirements varies considerably. While most respondents emphasized the additional burdens placed on their programming process by environmental regulations, some noted positive effects. These included the availability of additional funds through ISTEA for environmental activities, and improved environmental conditions resulting from special programs or mitigation efforts.

In general, the impact has been significant regarding air quality, wetlands and water quality. The passage of ISTEA in 1991 provided specific funding (i.e., CMAQ) to transportation programs/projects that contributed to the attainment of a National Ambient Air Quality Standard (NAAQS). At the time ISTEA was passed, Florida had six counties that were in non-attainment, five of which were eligible for CMAQ funds. As of this date, all six counties have achieved attainment and are in a maintenance status. Due to a strict interpretation of the CMAQ program, Jacksonville/Duval County, as a transitional area, cannot receive CMAQ funds. In addition, the six counties in non-attainment status when ISTEA was passed were allocated off-the-top Federal MPO Planning (PL) funds to complete air quality studies and complete activities to monitor progress. This allocation is still in effect. State regulations have also significantly impacted project scheduling in regard to wetlands and water quality, requiring additional permits and in a number of instances the substitution of wetland areas for permission to proceed with a construction project. In light of the increased emphasis on environmental concerns, the Department has established a program to acquire land to bank for future environmental mitigation opportunities.

—Florida Department of Transportation

Air Quality

The impact of air quality regulations is also a major factor for many DOTs: 46 percent report that air quality requirements have a significant impact on programming. At the same time, more than one third of respondents (13 states), generally those without nonattainment areas, reported little or no impact due to air quality regulations.

Most agencies that find air quality regulations to be significant experience delays in project scheduling and increased project costs. Some agencies identified problems integrating state and federal regulations. For example, Washington reports that changes in EPA's air quality models resulted in problems

TABLE 4
IMPACT OF STATE LEGISLATION ON CAPITAL PROGRAMMING

Type of Legislation	Specific Action Taken	States Reporting
Revenue Expansion	Increased gas and diesel fuel taxes to fund 15-year Highway Improvement Program (\$48.5M/year)	Arkansas
	Resolution to support \$1.1B in state revenues for Interstate-15	Utah
	Minor changes in allowable district contributions and computation of bond caps to increase feasibility of toll projects	Florida
	Approval of \$12.6B five-year capital program (matching state/federal funds)	New York
	Increase in DOT share of motor vehicle tax under consideration Implemented graduated six cent fuel tax	Oklahoma Missouri
Revenue Reduction	Pending elimination of scheduled increases in fuel tax	Connecticut
	Reduced mineral royalties allocated to DOT	Wyoming
Public/Private Ventures	Passage of Public/Private Transportation Act to allow private construction and operation of facilities	Virginia
Fund Allocation	Require CMAQ and STP 133(d) funds to be apportioned to MPOs according to federal formula	California
	Relaxation of requirement that 90 percent of state and federal funds be allocated to maintenance	Michigan
Financial Management	Require balanced Six-Year Highway Plan with legislative approval required for cost overruns greater than 15 percent of the plan estimate	Kentucky
	Allow multiyear funding of major projects	New Jersey
	Require increased project cost estimate detail provided to legislature	Vermont
Programming Process	Revise prioritization/programming process	Delaware Washington
Facility Standards	New pavement guidelines	Hawaii
	Require railroad crossing safety improvements on State Trunk System	South Dakota
	Mandatory annual Highway Needs Study for geometrics and structural deficiencies	Nebraska
Reorganization	Adopt state system structure based on primary, secondary and urban system	Montana
	Create DOT, incorporating former Highway Dept. and other agencies	Wyoming

with TIP approval and CAA conformity for some sections of the state even though there were no monitored violations. Extensive negotiations were required to resolve differences between the Washington State Clean Air Act and EPA requirements.

Complying with Federal conformity regulations causes delays in TIP submittals by adding time to the development and approval process. A non-conforming TIP analysis necessitates review, some reprogramming and a new approval process of the TIP before submitting to Federal agencies. A conforming TIP also requires additional time (and resulting costs) to run the conformity analysis models. More time is also required for Federal review and approval of the TIPs and Air Quality conformity results. The added cost of adding air quality analysis to the TIP development process is about \$30,000 per year, per county.

—Michigan Department of Transportation

Some agencies particularly noted the positive contribution of the Congestion Mitigation and Air Quality (CMAQ) program on their ability to respond to air quality concerns. In Oklahoma, with no nonattainment areas, air quality issues

have not affected project schedules or costs but 20 percent of that state's CMAQ funds have been allocated to MPOs for projects to improve air quality and maintain attainment status. Most of these funds were used to support free fare transit services on clean air alert days.

Projects with positive air quality impacts have been advanced in the six air quality maintenance areas, largely funded through the Congestion Mitigation and Air Quality (CMAQ) improvement program of s.149 of ISTEA. These projects have included environmental studies for major multimodal and intermodal facilities; bus conversions; bicycle/pedestrian projects; intersection/traffic signal improvements; and ridesharing/vanpool and carpool efforts. The CMAQ program has allowed earlier scheduling and implementation of these kinds of projects.

Two air quality maintenance areas have advanced commuter rail projects to meet conformity on new long-range plans. Tampa shifted highway funds to finance a 70-mile commuter rail project. Jacksonville's commuter rail project was phased in earlier than planned to meet conformity. However, both these projects were accomplished without CMAQ funding. The MPOs have advanced the phasing of highway projects, in some instances, to meet conformity.

—Florida Department of Transportation

TABLE 5
IMPACT OF ENVIRONMENTAL REGULATIONS ON CAPITAL PROGRAMMING

Environmental Regulation	Level of Significance			Total
	High Impact	Moderate Impact	Little/No Impact	
Air Quality	17	7	13	37
% of respondents	46	19	35	
Noise	3	12	22	37
% of respondents	8	32	60	
Wetlands	19	11	9	39
% of respondents	49	28	23	
Water Quality	7	13	19	39
% of respondents	18	33	49	
Other				Total
Endangered and Threatened Species				5
Habitat Fragmentation/Preservation				2
Federal Regs/Bureaucracy/Review				4
Historic Preservation/Archeological				3
Farmland Preservation				2
Hazardous Material/Waste Disposal				2
Environmental Justice				2
Chemical/Dust Emissions				1
Aesthetics				1

Finally, a number of agencies noted that the conformity analysis required for TIPs in nonattainment areas created a barrier to making changes to projects or programs that would otherwise be desirable and not have negative air quality impacts.

The rigorous air quality conformity requirements for federal TIPs significantly increases the time required and staff costs to prepare or to modify federal TIPs. The flexibility in programming and project selection is thus limited.

Under the Federal Clean Air Act, MPOs must prove that the transportation project(s) do not negatively impact the region's air quality. This is a paper process that takes a great deal of resources by the local agency.

Conformity determinations have a life cycle that expires. Expiration dates for plans and TIPs are different. Project rescheduling may not be possible if a new determination is needed. Due to the cost, MPOs are reluctant to remodel unless absolutely necessary. Projects that have been modified to an extent that is not consistent in scope and plan may require a new conformity determination and may not be programmed.

Bottom line—the added “steps” mean that projects may not be programmed or delivered (regardless of the availability of funds) in the timeframe envisioned by the community or the state.

—California Department of Transportation

Noise

Regulations related to noise have had the least influence on most transportation agencies: 22 agencies (59 percent) reported that regulations regarding noise have had little or no

impact on their programming or project scheduling. Most of these indicated that they had a well-developed and effective noise evaluation and abatement program in operation prior to ISTEA. An additional 12 agencies reported a moderate impact. Three state DOTs, California, Florida, and Washington, report a significant impact due to recent federal noise regulations.

Federal noise impact regulations have extended the planning phase of capital project programming by requiring technical studies to be conducted when they are not warranted (e.g., noise impact studies for ramp widening projects). They have also extended the design phase and costs for project implementation.

Projects are generally programmed and scheduled as if they were eligible for federal funding. FHWA's noise impact criteria contained in 23 CFR 772 requires consideration of noise attenuation features on projects when projected noise levels approach or exceed the noise abatement criteria. This frequently results in consideration and construction of noise barriers for projects that cause only minimal changes (barely perceptible) in ambient noise levels. This results in extra costs and a longer time for implementation.

—California Department of Transportation

The impact of federal regulations on FDOT's capital program has been the additional cost of noise abatement required by 23 CFR Part 772. This has amounted to nearly \$29 million to date and is increasing daily. It has also resulted in numerous project delays and, in some cases, additional projects being programmed to deal strictly with the design and construction of noise barriers. Since State regulations in Florida mirror the federal requirements, no additional costs or delays have resulted from the State regulations.

—Florida Department of Transportation

Wetlands

In contrast to the relatively small impact of noise regulations, 49 percent of transportation agencies are finding that regulations related to wetlands have a significant impact on their programming; an additional 28 percent report a moderate level of impact. In total, over three-quarters of responding states find management of wetlands environmental requirements to be an important factor in their program development. Most agencies reported significant project delays and increased project costs due to wetlands regulation compliance activities. One agency, for example, estimated that approximately \$1 million per year of funding is reallocated for environmental studies related to wetlands.

Iowa is currently developing a wetland banking solution to help manage what it finds to be a significant problem. Washington reports that they have executed an agreement among all agencies involved in wetland banking, and have identified three watershed sites for work; program implementation will begin when funding is secured.

In Connecticut, the issue of "habitat fragmentation" and impacts to non-regulated uplands rather than strict wetlands impact has been tied into the federal permitting process by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency. This has dramatically extended the time required to select viable transportation alternatives and has hindered the ability to utilize hundreds of millions of dollars of transportation investment.

—Connecticut Department of Transportation

KDOT has two full-time staff to evaluate wetlands and coordinate permitting activities. Because of this level of effort, wetlands have not normally resulted in project delays due to the early identification and coordination of potential impacts.

—Kansas Department of Transportation

Wetlands mitigation, as required by federal Clean Water Act along with delegated state programs, tends to drive up project costs and delay contract lettings while regulatory agencies dispute details of mitigation requirements. Although wetland avoidance does not impede scheduling, it increases right-of-way costs. Wetland mitigation can increase capital costs one to five percent.

—Missouri Department of Transportation

Water Quality

Only seven agencies reported that water quality regulations are having a significant impact on programming and project scheduling at this time. However, one third of the respondents (13 agencies) reported that these regulations have had some impact. Project changes and cost increases due to National Pollutant Discharge Elimination System (NPDES) regulations were most often cited. Alaska estimates that project costs increase two to three percent to handle stormwater runoff. Oklahoma noted that the "Clean Water Act has required major

expenditures to local governments for NPDES permitting." Montana reports that it has applied enhancement funds to mitigate runoff pollution.

Agencies frequently commented that they are expecting regulations related to water quality to be increasingly important. For example, Michigan noted that, although water quality issues had not been significant so far, they recognized that NPDES regulations could potentially result in large costs in Michigan's urban areas.

Federal Clean Water Act stormwater regulations as implemented by state water quality agencies have caused approximately a two to three percent increase in construction costs on larger roadway projects. Section 404 (and 401) as implemented by state (Department of Natural Resources) and federal agencies (Corps of Engineers) tends to drive up project costs one to two percent but generally does not impede scheduling or programming.

—Missouri Department of Transportation

Other Environmental Regulatory Issues

Several agencies mentioned additional factors related to environmental regulation that impact their programming practice. Seven DOTs identified the effect of requirements related to endangered species and habitat protection. New Jersey, West Virginia, and Vermont each mentioned issues related to historic preservation and archeological regulations. New Jersey estimates that managing historic preservation requirements often requires 2 to 3 years in additional project development time.

Four respondents specifically mentioned the impact of multiple agencies with review authority and federal review processes in general, which they found to be unnecessarily cumbersome and costly relative to the intent of the environmental regulation. North Carolina recommended the creation of an "arbitrating committee" to resolve differences among various permitting agencies and to have final authority for permit implementation.

Changes in any federal or state environmental law or regulation that becomes applicable to a project that is nearing construction, as well as changes to a project late in its development, often are a real problem in meeting the capital program and the individual project's schedule.

—California Department of Transportation

FINANCING METHODS

State transportation agencies have been very active in pursuing innovative financing to support facility development. Two-thirds of the respondents report that they have developed new financing methods or identified new funding sources. These new sources range from the new use of toll roads to creative use of local and private sector contributions to provide the match for federal funds. These mechanisms, and

their effects on agency programming and scheduling, are discussed in chapter 6.

UNCERTAINTIES AFFECTING PROGRAM DECISIONS

Successful programming inherently involves working with a wide range of factors that are likely to change over time, some of which are beyond the control of the state transportation agency. The study survey asked agencies to gauge how significant four of these uncertainties were as they affected program decisions: 1) changes in project costs and schedules; 2) federal and state funding; 3) weather; and 4) natural disasters. The first two factors are present in all states and represent risk factors that an agency can anticipate and manage to some degree. The second two factors represent potential areas of vulnerability that vary widely from state to state and reflect natural and climatic features. In addition to these factors, a number of agencies identified a change in administration as another uncertainty with potentially significant impact on the program in terms of policy direction and priority.

Changes in Project Costs and Schedules

Nineteen agencies reported that changes in project costs and schedules had a highly significant impact on their programming process; an additional 11 agencies reported a moderate level of impact. States with relatively small overall budgets are particularly affected by cost increases. As Wyoming noted, "Due to our low budget amount even \$2-3 million in cost increase overall can drastically change the STIP."

A number of agencies mentioned "scope creep" during the project development process as a continuing issue and challenge to program management. In at least two states, the legislature has strengthened their oversight role with respect to project cost changes and a number of states have established clear cost change threshold criteria requiring increasingly more senior management review and approval. Finally, a number of states are attempting to improve cost and schedule estimate reliability as part of a comprehensive review of the project delivery process.

As discussed in earlier sections of this chapter, the fiscal constraint requirement of ISTEA has increased the importance of good project cost and schedule estimates. The reduced flexibility in having substitute projects available and the STIP/TIP amendment process can make responding to project schedules and cost changes more difficult.

Some agencies that manage programs on a multiyear basis have been able to achieve more satisfactory control over the impact of project changes on their programming process. In the case of Maryland, both value engineering and downscoping were mentioned as tools to minimize and manage project cost changes.

Changes in project costs or schedules may have an effect on which projects actually reach construction in any given fiscal year but do not affect MDOT's ability to successfully deliver a Statewide program at the intended template level. Working within the flexibility of the three-year STIP document, MDOT will make adjustments to the Statewide program in response to any unexpected changes in project costs or schedules which are of high impact to the program.

—Michigan Department of Transportation

Federal and State Funding

Nineteen agencies identified predicting federal and state funding levels as a highly significant uncertainty affecting their programming process. Key issues included the lack of timely information concerning federal aid; reductions in the level of federal funding; and the occurrence of unexpected cuts in funding levels. Mississippi reported that a loss of approximately \$13 million in federal funds in fiscal year 1996 resulted in the rescheduling of several projects. Other DOTs, such as Utah, are deferring projects based on anticipated cuts in federal allocations.

Once we determine our annual federal aid apportionments and obligation ceiling programming proceeds rather smoothly. However, when we don't know this information our programming suffers. So far state funding has not been a problem, but that may not continue into the future.

—Montana Department of Transportation

Several agencies suggested that, regardless of the actual level of federal funds, more advance information about appropriation levels would significantly improve their capacity to reasonably develop their program.

The FHWA needs to share projections of appropriation distributions to each state throughout the life of the transportation act. While many factors cause projections to change, FHWA is in a better position to project and revise the distributions than the states are. Since the federal funding levels are critical to developing the federal State Transportation Improvement program, the best projections are necessary.

—California Department of Transportation

In general, agencies that reported that they are less impacted by shifts in federal funds tended to have a financial "buffer" from state resources. These sources may include a transportation trust fund; dedicated revenues from tolls, fees, or other income sources; or special state appropriations for capital projects. North Dakota's Legislature enacted a "trigger state gas tax" based on increments of the actual federal aid available by year. In general, agencies view projections of state funding as more reliable than assumptions about federal aid, particularly as the ISTEA authorization period ends. Exceptions include events like unexpected court decisions, which recently diverted \$60 million from Alabama's program.

TABLE 6
UNCERTAINTIES AFFECTING CAPITAL PROGRAM DECISIONS

Uncertainty	Level of Significance			Total
	High Impact	Moderate Impact	Little/No Impact	
Natural Disasters	11	7	18	36
% of respondents	31	19	50	
Weather	10	9	18	37
% of respondents	27	24	49	
Changes in Project Costs/Schedules	19	11	8	38
% of respondents	50	29	21	
Federal/State Funding	19	7	11	37
% of respondents	51	19	30	

Agencies that have developed proactive management strategies related to federal funding also report more ability to manage shifts in federal support.

Some uncertainty at beginning of the federal fiscal year may delay projects, or an increase in federal funds may cause some projects to advance to an earlier letting. When state revenues are received, in excess of annual appropriations, these additional revenues are taken into consideration in the following year's appropriation and programmed to highway transportation projects. Federal revenues received, that exceed projections, are used to advance future projects.

—Nebraska Department of Roads

Our practice has been to annually develop a five-year program within each Region, with assumed resource levels set at ISTEA authorization levels and at best guess of State funds for the period. The Department works with MPOs and local officials to develop the program based on our best estimate of state, federal and local funds. If the level of any of these fund sources changes significantly, we work with those same officials to correct the imbalance. This strategy is reassessed annually at [the] program level, with objective of maintaining continuity and stability in program size and direction within changing Federal and State environment. Post-ISTEA funding programs and levels are major uncertainty.

—New York State Department of Transportation

All projects [are] designed to be eligible for federal funding. Project funding assigned based on managing state/federal fund at the program level. Project funding changes if necessary to manage the overall program within changing funding levels.

Projects rescheduled as a last resort and each rescheduling is worked out between central and district offices.

—Wisconsin Department of Transportation

A few agencies noted that increased flexibility in the use of federal funding has also provided more flexibility in responding to unanticipated funding shifts.

Weather and Natural Disasters

Ten agencies report a problem managing weather related uncertainty; 11 report significant effects due to natural disasters in recent years. (See Table 6.) The nature and severity of these factors varied depending on the specific "events" that occurred. One agency's comment was instructive in that regard: "Natural disasters are not a problem until they occur." Clearly the risk and vulnerability to severe weather and natural disasters varies by state. Where the risk is low, agencies perceive little uncertainty or impact on the program.

In states that have dealt with recurring severe weather or natural disasters recently, a combination of federal disaster relief or state emergency funds often have substantially mitigated any significant impact to the regular program of projects. Some of these states have established emergency funds or revolving funds while others respond to specific events. In the case of North Carolina, steps are being taken to reroute some roads to minimize risk to weather related events.

PROGRAMMING AND PROJECT SELECTION METHODS

As discussed in chapter 2, there are a number of key steps in the programming process: from establishing goals and objectives to monitoring the impact of program implementation on system conditions over time. The survey of state transportation agencies conducted for this synthesis focused on four key issues related to this process: priority setting criteria and methods, use of management systems, multimodal and program level tradeoff analysis, and public involvement.

In each of these areas the focus was on the technical methods, data, and criteria used to inform what are fundamentally political and policy choices. In addition to the summary information presented in this chapter, Appendices D and E contain more detailed summaries of selected states' approaches to dealing with these aspects of programming.

PRIORITY-SETTING TOOLS

Defining Objectives and System Performance

An effective programming process establishes program objectives at the start of the process and measures progress toward reaching those objectives as the program is implemented over time. Furthermore, unless these objectives, or at least some of the performance measures used to monitor results are quantifiable, it is difficult to assess progress and hold the process accountable for results. Thus the first issue that was explored was the extent to which state transportation agencies use quantifiable measures to define objectives and measure performance. The expectation is that if such measures are used they also can provide a basis for screening projects and setting priorities. It is also recognized that in many agencies program objectives and performance measures are established in policy and system planning efforts that provide a framework for programming.

Based on the survey, agencies take a variety of approaches to establishing their overall program objectives and to measure their progress in achieving these objectives. As summarized in Table 7, many agencies are using some type of quantifiable measures to define objectives and performance. Eighty-two percent of responding DOTs reported that they had some measures in place or were actively developing quantifiable measures to use in the future as a tool to help direct and evaluate their program decision making. While some agencies established statewide objectives and performance measures, others, such as Minnesota, have adopted a decentralized approach for some or all objectives.

The most frequent types of quantitative measurements to define objectives were conditions measures, which included pavement and bridge ratings, sufficiency/deficiency ratings, and other rating methods based on facility inspection data.

Quantitative measurements of capacity and level of service were the next most frequently used measures with approaches varying from the use of traffic counts and traffic forecasts to volume/capacity ratios and level of service indicators. Three agencies mentioned the use of some form of congestion index. Safety, a variety of strategic or economic impact measures (e.g., job creation), and environmental measures were also used by a number of states to define objectives or measure performance.

Although not specifically included in the survey, a variety of productivity or program delivery measures used to assess program accomplishments were mentioned by a number of agencies. These measures included items such as the miles of pavement rehabilitated or resurfaced, number of bridges repaired, etc. Though only a few of the agencies responding to the survey offered information on measures of program delivery, historically many states have used such measures and, in fact, delivery measures are still likely to be more prevalent than system performance measures as a method of tracking program results.

Threshold Criteria and Priority Setting

Most DOTs do not use threshold criteria to limit the number or type of projects that are submitted for evaluation and priority setting. Only 13 agencies reported that they use threshold criteria; in contrast, 22 agencies reported that they evaluate all projects that are submitted and use financial constraints as the primary mechanism for determining total program size. New York and Pennsylvania use threshold criteria on a regional/field office level. Wisconsin provides advisory criteria to its district offices. Not surprisingly, agencies that have developed quantitative measures for defining objectives and evaluating performance are more likely also to have established threshold criteria for screening projects.

A wide range of approaches is used in setting priorities. From an organizational point of view, priorities may be set on a statewide basis or at a substate or regional level. Clearly, for designated MPOs all project selection must occur within the framework of the MPO process and the development of the TIP. However, some DOTs (for example Minnesota and California) are moving toward a more decentralized approach throughout the state. Finally, some agencies set priorities on a statewide basis for some program categories (typically pavement and bridge preservation) while adopting a decentralized approach for others (typically system operations/management and improvement). No agencies reported having a truly multimodal approach to priority setting at the project level except within MPO regions. However, a number of agencies, such as Oregon and Wisconsin, have developed statewide plans that

TABLE 7
USE OF QUANTIFIABLE MEASURES TO DEFINE OBJECTIVES AND MEASURE PERFORMANCE

	Number of States	Unduplicated Totals	Percent
<i>Use Quantitative Measures to Define Objectives and Measure Performance</i>			
Total Responses		39	
Yes/Under Development	32		82
No	5		13
No response	2		5
<i>Type of Measures Used</i>			
Condition Measures		21	54
System Condition Ratings	5		13
Bridge Safety and Condition Ratings	17		44
Sufficiency/Deficiency Ratings	11		28
Pavement Management/Condition Measures	19		49
Maintenance Condition Survey	1		3
Rail Sufficiency Ratings, Conditions	1		3
Capacity Measures		10	26
ADT/Traffic Counts & Forecasts	3		8
Congestion	3		8
Volume/Capacity or Level of Service	6		15
Safety Measures		6	15
Accident Frequency	2		5
Safety	4		10
Cost/Benefit Measures		5	13
Cost/Benefit; Value/Cost	5		13
Needs Prioritization Measures		2	5
Funding/Priority Formulas	1		3
Relational Evaluation of State Needs	1		3
Strategic/Economic Impact Measures		5	13
Strategic Planning Objectives	2		5
State Statute Priorities	1		3
Community Goals	1		3
Economic Development	1		3
Environmental Measures		2	5
Environmental Needs	1		3
Conformity	1		3
Land Use	1		3

provide guidance to modal investments at the program level. In addition, Maryland has had a multimodal planning and programming process at the program level for many years where a unified fund has always allowed multimodal program tradeoffs to be made.

In terms of priority-setting methods, again approaches vary depending on the degree to which more formal and technical priority-setting criteria or analysis methods are used to rank or sort projects. Eventually, in every case, final project selection decisions reflect a range of technical, policy, and financial factors. Alaska, California, Illinois, Kansas, and Nevada provide examples of prioritization systems developed to varying levels of specificity based on the needs and program objectives of each agency. Appendix E contains descriptions of the approaches used by these and selected other states. Table 8 summarizes the priority-setting approaches most frequently used by the states responding to the survey.

As shown in Table 8, the frequency of use of the various approaches shown (e.g., cost-benefit analysis, cost effectiveness, etc.) is very similar but the project or program categories

for which the various techniques are applied vary considerably. Cost-benefit analysis is most frequently used to evaluate safety projects or highway improvement projects. Four states use cost-benefit primarily for major highway capacity improvements or high-cost projects. Sufficiency and deficiency ratings are used primarily for bridge and pavement projects. Cost-effectiveness approaches and other priority ratings are used across a broad range of categories with no one type of project being the primary focus. Pavement and bridge management systems are the primary management systems used to help set project priorities, although some agencies are using their safety, intermodal, and congestion management systems as well. Other priority criteria that were mentioned (the "other" category in Table 8) included conformity, community input, environmental factors, vehicle life-cycle cost, economic development impacts and cost sharing by local government. For example, states such as Ohio, Michigan, Washington, Wisconsin, and others use a variety of economic development indicators including job creation and priority economic development corridors or connections. Only two agencies did not

TABLE 8
PRIORITY METHODS USED BY TRANSPORTATION AGENCIES

Primary Method	Total Number of Users	Use of Priority Method	Number of States		
Benefit/Cost Analysis	26	Safety Programs	13		
		Highway Project Evaluation and Selection	8		
		Operations	2		
		Major Projects	4		
		Development	1		
		Congestion	1		
		Construction versus Rehabilitation	1		
		Value Engineering	1		
		Fish Barrier Removal	1		
		Cost/Effectiveness	20	Design and Feasibility Studies	2
		Operations	1		
		Major Projects	2		
		Safety Programs	3		
		Highway Projects	3		
		Pavement Programs	5		
		Bridge Management	2		
		Value Engineering	1		
		Maintenance	1		
		Sufficiency/Deficiency Ratings	29	Bridge Ratings	20
				Safety Ratings	1
Project Evaluation	1				
Pavement Ratings	15				
Major Projects	2				
Traffic Ratings	1				
Other Ratings	1				
Other Priority Ratings	22			Project Evaluation	1
				Safety Programs	6
				Pavement Programs	4
				Maintenance Cost	1
		Intermodal Programs	5		
		Bridge Programs	1		
		Economic Benefit	1		
		Highway Programs	1		
		Congestion Management	1		
		Value/Cost	1		
		Traffic	3		
Planning Factors	3				
Accident Records	2				
Management Systems	38	Bridge	30		
		Pavement	33		
		Safety	14		
		Congestion	6		
		Highway	5		
		Intermodal	1		
		System Preservation	1		
		Geometrics	1		
		Project Evaluation	2		
		Other	12		

report the use of any quantitative method as part of their prioritization process.

MANAGEMENT SYSTEMS

The results of the survey indicated that almost all of the responding agencies (97 percent) either had or were developing one or more management systems. This survey was conducted after the ISTEA management systems requirement was made voluntary. Pavement and bridge systems were reported to be

available or under development in 87 percent and 79 percent of the responding states respectively. Thirty-eight percent reported having or developing a safety management system. No other type of management system was reported to be available or under development by more than 20 percent of the responding states. These results are consistent with the results of a recent survey conducted by the Planning Task Force on Management Systems of the AASHTO Standing Committee on Planning, which found an even higher percentage of DOTs reporting that they had management systems, most often for pavements and bridges. (3) That survey found that 100 percent

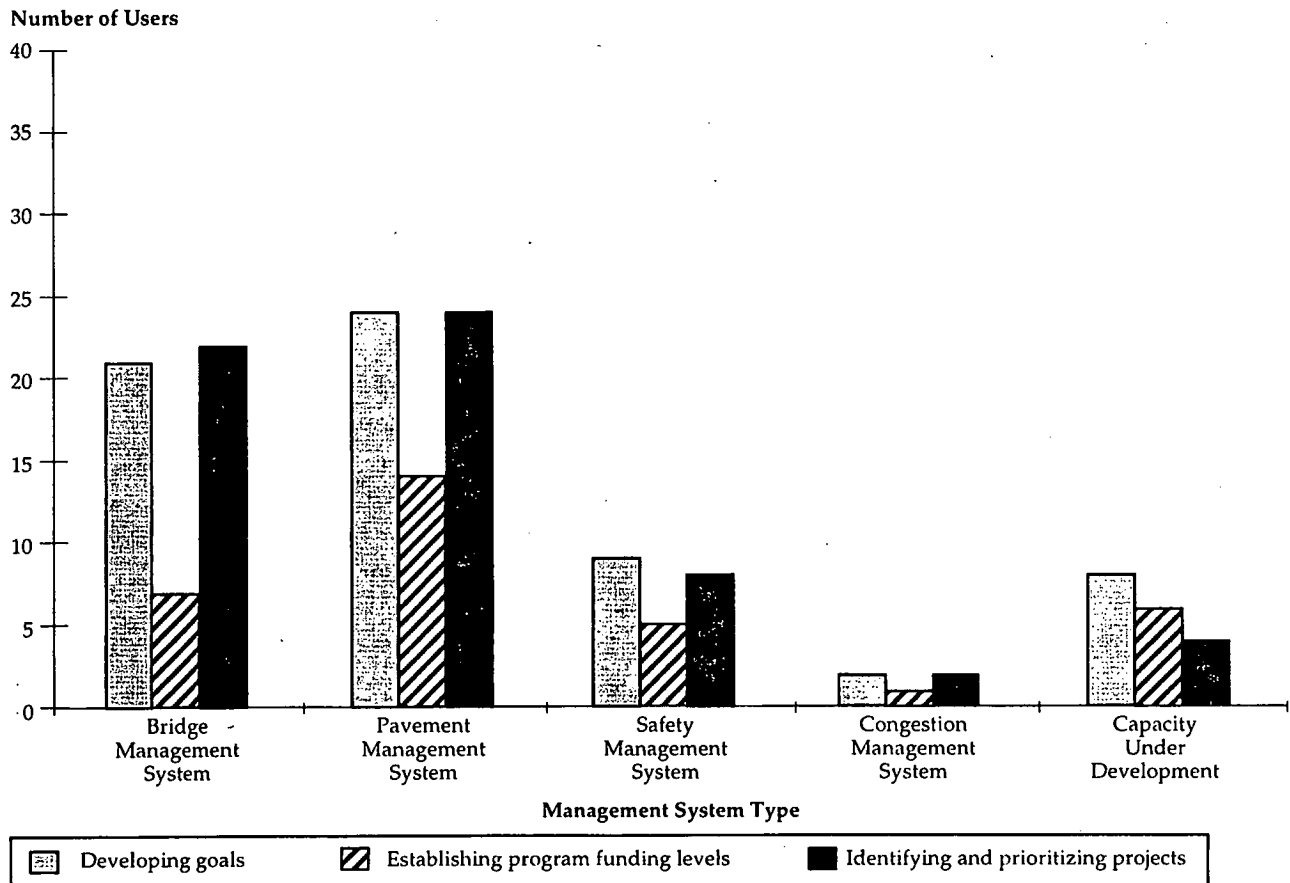


FIGURE 2 Use of management systems.

of the 38 responding agencies had pavement and bridge management systems in place or expected to implement them by 1997. Ninety-seven percent of respondents reported implementation of safety management systems by 1996; 72 percent expected to have intermodal management systems implemented by 1996.

While asset-based facility management systems, and particularly pavement and bridge management systems, have been under development in many states for a number of years, and preceding the ISTEA legislation in many cases, the concern in this survey was the extent to which any of these systems was actually being used in programming. Though management systems may be useful for applications outside of programming, such as tracking facility conditions over time, one of the primary justifications for such systems is to provide a new tool for making resource allocation decisions. Somewhat surprisingly, when asked whether any management systems were used to support a variety of programming related decisions, a much smaller number of responding agencies reported using the management systems at this time.

The survey asked states whether they were using any of their management systems to:

- Develop program goals;
- Establish program or subprogram funding levels;
- Set project priorities; or

- Establish capital versus maintenance funding levels for preservation.

Figure 2 summarizes the use of management systems tools for programming related decisions.

It appears that many DOTs are using management systems primarily to record and monitor infrastructure conditions or are experimenting with different potential applications but have not determined what, if any, role the systems may play as decision support tools. Far fewer agencies report the use of management systems for management decision making on a program level. For example, although 33 agencies reported having a pavement management system (PMS) in place, 27 percent of these agencies are not yet using their system to assist in establishing goals or in prioritizing projects. An even higher number—58 percent—do not use their PMS to assist in establishing funding levels.

The use of bridge management systems (BMS) by DOTs with such a system in place follows a similar pattern. About 70 percent of agencies with a BMS use the system to set goals or project priorities and only 23 percent used their BMS to help establish funding levels. As shown in the charts, the safety management system was the only other type used for program related decisions by a significant number of agencies. Three or fewer agencies reported using the congestion, public transportation, or traffic monitoring management systems for programming

related decisions. Only one agency reported the use of an intermodal management system, although some DOTs are in the process of developing an integrated and comprehensive management system capability. Michigan's development of its Transportation Management Systems (TMS) provides one example. The TMS will include all of the management systems originally required by ISTEA legislation in an integrated environment. All of the systems will support Michigan's "Call for Projects" process of identifying system deficiencies and generating investment strategy scenarios (4). The survey also indicated that relatively few agencies use their management systems to look at tradeoffs between capital and maintenance expenditures. Only 13 agencies (33 percent) reported that they use their pavement or bridge management systems to evaluate the allocation of funds to maintenance versus capital expenses. An additional six agencies noted that they have this capacity under development.

Some of this lack of use of the PMS or BMS to examine capital/maintenance funding tradeoffs reflects the varying approaches that transportation agencies have to the management of capital and maintenance funds. Eight DOTs report that their budgets for the two activities are completely segregated. Fifteen DOTs take the approach of fully funding a specified level of preventive maintenance/preservation activities, and then apply the remainder to capital expenditures. In contrast, six DOTs reported that they first ensure a full state match for available federal aid, and then allocate remaining state resources

to maintenance. While not specifically reported by any survey respondents, some agencies' management systems may not have the technical capability to look at both capital and maintenance actions.

There are several factors involved in these very different approaches to managing capital and maintenance fund levels. DOTs with limited state resources for infrastructure expense are more dependent on federal money, and therefore have less flexibility in allocating funds to projects that are not eligible for federal support. Some agencies are subject to state legislation that defines the capital/maintenance tradeoff. Other agencies simply may not have the technical capacity or adequate data to analyze the cost-effectiveness of maintenance versus capital investments.

Barriers to Fuller Use of Management Systems

Overall, the responding agencies reported low levels of use of all management systems except pavement and bridge management systems, and significant limitations in the types of uses of the management systems they did have in operation. The survey asked agencies to identify the key barriers to their full use of management systems (Table 9). Their responses can be grouped into four categories:

**TABLE 9
KEY LIMITATIONS AND BARRIERS TO MANAGEMENT SYSTEM USE**

Category of Concern	Specific Limitation or Barrier	States Reporting
Data/System Integration	<ul style="list-style-type: none"> • Insufficient access to accurate historical data • Problems with timely data acquisition and analysis • Integration of data is difficult • Database creation issue re: implementation of bridge management system 	7
System Development/Implementation	<ul style="list-style-type: none"> • Systems not totally in place or adequately developed • Systems only being used for certain functions due to continuing development • Service needs 	13
System Utility	<ul style="list-style-type: none"> • Statutory requirements for infrastructure and use of funds limit usefulness of management systems • Need to incorporate judgment re: policy, liability, and financial capability with technical data • Current programming system works well • Benefit of additional management systems is not worth the expense • Systems are designed for state requirements; not federal • Federal requirements interfere with the usefulness of systems to State • ISTEA systems are somewhat redundant • Intermodal/CMS are subjective judgments; use of technical system is not effective • Other decision-making factors are more significant than technical factors • SMS: most accidents are not on highway; system is therefore unnecessary • Systems don't compare activities well 	11
Resource Limitations	<ul style="list-style-type: none"> • Not enough time/resources to develop and/or implement systems • Insufficient funding 	3

- Problems with data collection;
- Incomplete development or implementation;
- Limited usefulness of management systems to their programming process; and
- Resource limitations.

Eight agencies identified the acquisition of accurate or sufficient data as a major barrier to the effective use of their management systems. In particular, some agencies reported that they had insufficient historical data to use management systems to define objectives or measure performance at this time. Presumably over time this barrier may become less significant if periodic data collection cycles create time series data on facility condition and use.

Twenty-two agencies reported that they were in the process of further developing their management systems; many expected to use the systems for broader programmatic purposes once this capacity was in place.

Many agencies, however, identified concerns about the usefulness of further management system development. Concerns included inconsistent needs for data analysis between state and federal agencies; doubt that some management systems were relevant to the issues facing their particular state; and concern that the added value of additional management system development would not be worth the costs of development. Three agencies specifically cited resource limitations—of both funds and staff time—as a barrier to the development of additional management system capacity.

A 1995 Transportation Research Board workshop on programming methods and issues identified a number of factors that DOTs (and MPOs and transit agencies) believed needed to be addressed if management systems were to be more widely used to support programming decisions. These factors included:

- Integration with the basic business process;
- Support of top management; and
- Strong involvement of planning.

In terms of integration with the business process, the key point was to avoid viewing management systems development as a separate activity or research effort divorced from the day to day operations of the agency. If management systems are going to be used as decision support tools they must provide useful and timely information to decision makers. In the case of resource allocation decisions, management systems have to reflect the resource allocation process in a particular agency and provide both technical and policy information in a manner that is understandable and credible to top management.

Not surprisingly, the second factor that participants identified to encourage greater use of management systems was to gain strong support from top management. While management systems can provide support to a variety of levels or functions within a DOT (e.g., condition assessment, deployment of maintenance forces, project design, and program decision-making), top management needs to be convinced of the value and credibility of these tools. To the extent that management

systems can support executive level policy and budget decisions such support is more likely to develop.

Finally, the strong involvement of planning in developing and using management systems was also emphasized as a key factor in encouraging greater use of management systems. Management systems best potential maybe in addressing broad policy and resource allocation decisions that are part of the policy and system planning activity in many agencies. Management systems offer potential to strengthen the connection between planning and programming.

PROGRAM-LEVEL TRADEOFF ANALYSIS

Another aspect of the programming process that the survey addressed was the extent to which DOTs explicitly consider program tradeoffs, and their approach to evaluating program-level tradeoffs. Two types of program-level tradeoffs were of interest:

- Multimodal tradeoffs (e.g., transit vs. highway, etc.); and
- Type of work or funding category (e.g., preservation vs. operational/management vs. capacity improvement, etc.).

The extent to which either or both of these types of program-level tradeoffs are explicitly considered is influenced by state statutes concerning the structure and use of transportation funds, allocation methods, and priority and performance criteria. The extent and nature of these constraints vary widely from state to state. Maryland has a unified fund that allows modal tradeoffs while many states have laws or constitutions restricting the use of some, or all, highway user revenue. In California, the issue of multimodal tradeoffs is addressed more at the regional than at the state level.

A recent NCHRP synthesis study reviewed the state of the practice in multimodal evaluation (based on information gathered in 1991 and 1992) (5). It identified 18 projects that undertook some degree of multimodal evaluation on a statewide, regional, or corridor basis. The report concluded that there was a need to develop more effective tools for multimodal evaluation. It noted that few mobility measures and no multimodal measures of mobility were identified or used in the projects. Furthermore, other criteria such as system coordination and integration, land use, freight, energy, safety, cost-effectiveness, equity, financial arrangements, and institutional factors often were not used as part of the evaluation criteria.

This lack of effective measures to evaluate multimodal solutions to transportation needs indicated that transportation agencies would have difficulty in assessing program tradeoffs on a multimodal level.

Four years later, the use of multimodal analysis is not yet widespread among state transportation agencies. Of the survey respondents, only 12 agencies (31 percent) reported that they use multimodal goals to some degree to set program direction. An additional seven DOTs said that they were in the process of developing multimodal goals. Kentucky, for example, commented that it is beginning to develop multimodal goals, focusing on the integration of air, rail, and highway services.

Some noted that the responsibility for multimodal planning in their states fell to other organizations, which included other state transportation agencies and the MPOs in their state.

The San Francisco Bay Area's Metropolitan Transportation Commission (MTC), which was profiled in NCHRP Synthesis 201, has continued to refine its multimodal project application process (6). Working through nine congestion management agencies in the metropolitan area, MTC uses a three-step approach to rank and program projects on a multimodal basis. First, proposed projects are screened using a set of threshold criteria. Projects that pass these thresholds are then ranked according to scoring criteria in five categories:

- Maintain and sustain the transportation system (maximum 30 points);
- Improve the efficiency and effectiveness of the transportation system (maximum 30 points);
- Strategic expansion of the transportation system (maximum 15 points);
- Maximize external benefits of the transportation system (maximum 25 points); and
- Cost effectiveness (maximum 10 points).

Final programming is conducted by the MTC based on the project rankings resulting from this scoring process, Commission priorities, and rules guiding fund distribution among the CMAs and counties.

Among agencies that use multimodal analysis, the level at which it is utilized varies. Most commonly, DOTs such as those in Oregon, Wisconsin, and Montana, develop multimodal goals at a planning and policy level. While these agencies' long-range plans include broad multimodal goals, the goals are not designed to influence specific year-to-year programming decisions. Specific project prioritization and program development is conducted on a mode-specific basis after overall resource allocation judgments are made. Montana noted that although it has a statewide multimodal planning process in place, state law is mode-specific, thereby precluding cross-modal comparisons of specific projects. States such as Alaska, whose infrastructure depends heavily on modes other than roads (nearly half of Alaska's National Highway System consists of ferry routes) and states with large urban populations are more likely to be using a multimodal approach with program-level tradeoffs based primarily on policy considerations. Washington is implementing an approach based on defining performance measures for multimodal program categories and providing the commission and legislature with some performance impact information to provide a basis for modal policy choices. As mentioned earlier, Maryland is one of the few states that have a unified transportation fund allowing multimodal analysis and tradeoffs at the program level.

The large majority of agencies report the use of mode-specific criteria within modes. Only seven agencies reported that they specifically use some level of multimodal criteria to compare projects across modes: Florida, Georgia, Hawaii, Maryland, New York, North Carolina, and Texas. Florida's Maximum Lane policy limits the level of travel demand that can be satisfied by highways in the form of general use lanes, thereby requiring

consideration of alternative forms of transportation to satisfy additional demand. Washington State assigns extra points to multimodal projects in its priority ranking system. Michigan noted that the implementation of their intermodal management system will enable them to have multimodal integration. Seven states reported the use of no specific criteria.

Agencies' approaches to program tradeoffs vary considerably as well. Fifteen agencies (38 percent) reported that they start their fund allocation process by determining the needs of their preservation/maintenance program; other program fund levels are then set using residual funds. (Far fewer agencies reported that they give specific priority to their capital program.) Pennsylvania's "maintenance first" approach is an example.

Other DOTs base their decisions on overall system performance goals. The Minnesota DOT has initiated a transportation investment process based on eight Area Transportation Partnerships. Overall policy direction is set at the state level, with emphasis on preservation and management of existing systems. Each substate region then selects its own priority projects within this framework, using individually designed criteria and processes. New York State also takes a decentralized approach, delegating program development and management decisions to its 11 regional offices.

Washington evaluates a series of program and subprogram tradeoffs in both its system planning and programming processes. Service objectives at the system planning stage and program performance measures at the programming stage are used to evaluate the tradeoffs of shifting funds among major program (maintenance, preservation, improvement) or subprogram categories.

Most DOTs have some system in place to evaluate performance and program effectiveness, although techniques varied considerably among the respondents. Of those agencies that use performance measures, most rely on condition measures (see Table 7). Other agencies evaluate program performance based on system goals, as identified in long-range planning documents. Washington State has developed a system based on program-level performance measures and priorities, which includes quantifiable objectives that are evaluated annually. Several agencies, including Minnesota, Nevada, Illinois, and Florida, noted that they produce annual performance reports to their state legislature and the general public.

PUBLIC INVOLVEMENT

ISTEA requires that public involvement be part of the programming process, and the survey documented the fact that all agencies include some type of public involvement in their programming process. The mechanisms for this involvement and the level of attention public participation is given vary considerably among states. Generally, involvement mechanisms include formal published notices, mailings to interested parties, public meetings, and a review and response process for the draft STIP. Agencies with strong MPO or regional structures (such as California and Minnesota) rely more heavily on a decentralized process for the management of public input. Other agencies focus on a statewide approach for soliciting public input.

Facing a need for substantial increases in resources to keep pace with the rehabilitation and expansion needs of its transportation infrastructure, the Ohio Department of Transportation decided to implement a new approach to public involvement in its programming and development process. *ACCESS OHIO* was designed to "get the message out" to the public and to build a more cooperative relationship with Ohio residents to generate support for the state's transportation needs.

In the first phase of *ACCESS OHIO*, beginning in 1992, ODOT held a total of 99 public meetings and listening sessions across the state, involving more than 5,000 persons, to forge a "Macro" plan for the future transportation system of the state.

In the second phase, 28 public meetings were held to review the "Micro" plan and select priority projects within local areas. ODOT appointed eleven focus groups to cover the portion of each of ODOT's Districts not covered by one of Ohio's sixteen MPOs. These focus groups worked directly with ODOT staff to review more detailed technical data including traffic counts, traffic forecasts, volume to capacity ratios and traffic accident information. This process resulted in a prioritized list of projects that were deemed necessary based upon capacity, congestion, pavement and bridge management systems information and forecasted traffic volumes. The process also validated about 85 percent of ODOT's existing pipeline projects.

Based upon the success of the *ACCESS OHIO* process, ODOT decided to develop a citizen involvement process to prioritize and select major new construction projects using a rating system adopted by the group. A Project Selection Advisory Committee was formed in September, 1995 to help ODOT develop a formal and public process to rank needs and select projects for major new construction. Through work with ODOT staff and input from public meetings, the Committee developed a point ranking system for major new multimodal construction projects and adopted key policies to guide project selection. These policies included:

- Transportation efficiency factors will have 70 percent of the weight in ODOT's selection process; economic development will have 30 percent weight;
- Project selection criteria will be derived from *ACCESS OHIO* goals;
- Bonus points will be assigned to projects based upon local public or private funding contributed;
- Ohio will build no new interchanges without at least a 50 percent contribution of the cost of the interchange from either private, local or other non-ODOT funds. ODOT may not require the interchange proponent to pay for the entire cost of improvements to the general purpose highway lanes affected by the project if the long-range plan indicates that lanes will be needed within five years of the scheduled interchange construction.

A permanent organization, the Transportation Review Advisory Council (TRAC), was created to review the rating criteria on an annual basis and to score projects for each year's STIP.

FIGURE 3 Overview of ACCESS OHIO.

Ohio has conducted an extensive outreach effort in response to ISTEA planning and programming requirements (9). Figure 3 summarizes the process Ohio DOT used to generate the statewide plan, and Table 10 shows the project scoring criteria developed as part of the process.

As summarized in Figure 4, Wisconsin implemented a three-stage public outreach program, and confirmed effectiveness of this process by conducting a random survey of Wisconsin residents.

Other agencies are experimenting with new outreach techniques to encourage participation in the transportation plan-

ning process. Illinois has an 800 number for questions regarding the programming process. Georgia held a statewide video teleconference as one mechanism to encourage participation of its Draft STIP. Vermont makes use of the Vermont Interactive Television Network "to provide simultaneous dispersed geographic access for public input"(8). Montana has implemented use of the Internet for input after experiencing low participation in public meetings and open houses. Pennsylvania publishes a "Users Guide to Transportation Planning" to educate state residents about its planning

TABLE 10

OHIO DOT SCORING CRITERIA FOR MAJOR NEW CONSTRUCTION PROJECTS EXCEEDING \$2 MILLION

Goal	Selection Criteria	Maximum Score
Transportation Efficiency	Average Daily Traffic—Volume of traffic on a daily average.	20
	Volume to Capacity Ratio—A level of highway's congestion.	20
	Highway's Classification—A level of highway's importance.	5
	Macro Corridor Completion—Does it complete a macro corridor?	10
Safety	Accident Rate—Number of accidents per 100 million miles of travel.	15
<i>Total transportation scores are at least 70% of project's maximum possible score</i>		70
Economic Development	Job Creation—The number of non-retail jobs the project creates.	10
	Job Retention—Existing jobs that can be documented to be retained if the project is constructed.	5
	Economic Distress—Points based upon the severity of the unemployment rate of the county.	5
	Cost of effectiveness of investment—A ratio of the cost of the jobs created determined by dividing the jobs created by the cost to ODOT for the transportation project.	5
	Level of Investment—The level of private sector, non-retail capital attracted to Ohio because of the project.	5
<i>Economic development scores can be up to 30% of project's possible maximum score</i>		30
Bonus Categories		
Funding	Public/Private/Local Participation—Does this project leverage additional funds which allow state funds to be augmented?	15
Unique Multimodal or Regional Impacts	Does the project have some unique multimodal or regional impact?	10
<i>Total possible points with all bonus points included</i>		125

Wisconsin DOT (WisDOT) approached public involvement in its statewide planning process (Translinks 21) using a three-stage process, and developed techniques to solicit input from both the general traveling public and from organized groups with specific interests. The first phase of public outreach was conducted prior to plan formulation, to gather information about transportation needs and issues free of the influence of a proposed plan. Input at this stage was sought through regional meetings, peer review forums, meetings with statewide organizations, and expert panels. Special outreach was conducted to ensure participation by minority, elderly, disabled, and low-income residents.

During the second phase, WisDOT presented four detailed plan alternatives for discussion and debate through ten regional meetings, open houses, focus groups, and one-on-one meetings with organizations. These sessions were extensively publicized to encourage participation. Nearly 6,000 written comments and surveys were received.

A recommended draft plan was developed that incorporated public priorities, based on the input received in the first two phases. A final round of public involvement was then held to finalize the plan.

To measure the effectiveness of this public participation process, WisDOT contracted with the University of Wisconsin-Parkside to conduct a random survey of Wisconsin citizens. Over two thirds (66.8 percent) of survey respondents expressed strong overall support for the plan; 17.3 percent disapproved. The survey also provided WisDOT with detailed information regarding public response to various aspects of the plan, including its plans for highway rehabilitation and corridor development, land use, environmental impacts, elderly and disabled transportation services, intermodal freight, and transit.

FIGURE 4 Wisconsin public involvement process (10).

process. Alaska is currently reevaluating its public involvement process. The Idaho Transportation Department (ITD) has developed a new format for a more "user friendly" STIP (8).

The Idaho STIP development process has the following objectives:

- Satisfy both FHWA and FTA requirements;
- Provide a document that the public can relate to and understand Idaho Transportation Department's (ITD) planning and programming process;
- Have a geographic focus, with maps, consistent with Idaho's six districts;

- Combine all transportation modes as well as highway safety; and
- Involve Idaho's three MPOs.

To achieve these objectives, Idaho created an Intermodal Working Group with representatives from ITD's planning, highways, public transportation, bicycle and pedestrian, rail, highway safety, aeronautics, districts, and public affairs offices, as well as FHWA and FTA. An improved level of internal planning and coordination has enabled ITD to develop more effective processes for TIP development with the MPOs and provide better and more accessible information to support public involvement and input.

FINANCING AND CASH MANAGEMENT

Another area of interest related to programming was the methods state DOTs used to forecast revenue and manage cash flow and the impact, if any, of ISTEA on these activities.

REVENUE FORECASTING

Federal Revenues

As the time period covered by any federal transportation authorization act comes to an end, projections of future federal funding levels, allocation formulas, program structure, and eligibility rules necessarily become more uncertain. States must recognize and deal with this uncertainty in the development of their STIPs and anticipate the need to make adjustments once a new authorization act is passed at the federal level. As the ISTEA legislation draws to a close, states again are dealing with the uncertainty of federal funding until a reauthorization act is enacted. However, beyond the uncertainty of future federal funding, most DOTs (77 percent) report that ISTEA requirements for a fiscally constrained STIP/TIP and the funding flexibility provisions had not changed their revenue forecast methods or created any significant problems with respect to revenue forecasting itself.

In the absence of definite information regarding future federal funds, most agencies are forecasting their share of federal support based on historic levels. Assumptions about the forecast run the gamut: some agencies assume that there will be a percentage decrease in federal funding levels, others assume level funding, and still others assume a straight line projection consistent with the historic trend that they have experienced. In the current political climate, some agencies are assuming changes to the minimum allocation formula or an increasing use of fuel tax revenue for deficit reduction but again these assumptions are generally reflected in federal funding forecasts by adopting some fixed percentage increase or decrease in expected federal revenue. Overall, DOTs are attempting to make funding projections that are reasonable for planning purposes, while fully anticipating that they will need to make programming adjustments after reauthorization legislation is passed.

Regarding obligation ceilings, most agencies are continuing to use the same assumptions they have used throughout the ISTEA authorization period. These assumptions on obligation ceilings ranged from 80 to 100 percent with most states adopting 90 percent as the target expectation.

We assume Illinois will continue to receive the same share of the national obligation ceiling it did during the ISTEA years. We assume the national ceiling will decrease each year to support balancing the budget. We have assumed no discretionary awards or demonstration projects beyond FY 97.

—Illinois Department of Transportation

State Revenues

Unlike federal revenues, which are subject to periodic reauthorization legislation, state transportation revenue sources tend to be perceived as more defined and stable and more amenable to sophisticated forecasting methods. While these forecasts have to reflect a variety of demographic and economic factors as well as state legislative action concerning both the revenue sources available for transportation and the levels of specific taxes and fees, most states have well-defined procedures for forecasting state revenue trends to support short- and long-term planning, programming, and budgeting. As a result, no agencies believed that the ISTEA requirement for fiscally constrained STIPs and TIPs created any problems in terms of forecasting overall revenue levels. Some agencies did acknowledge that the process of generating overall forecasts at the state level and then providing either specific forecasts or at least guidelines on revenue expectations to MPOs or the regional level created the need for a new negotiation and review process in terms of these forecasts.

State transportation agencies use a variety of techniques to forecast state revenues. The majority of agencies use some form of econometric analysis, which is usually undertaken directly by the agency. These forecasts vary from simple historic trending to more sophisticated modeling involving multiple demographic, economic, and usage factors, based on the specific revenue sources involved. For example, a typical method for forecasting fuel tax receipts is based on forecasts of vehicle-miles traveled (VMT) and vehicle fleet fuel economy. Other agencies forecast the growth in population, vehicle ownership, and licensed drivers to estimate VMT growth. For longer-term forecasts, some states, like Washington, relate the level of state transportation revenue to an underlying economic variable such as personal income.

In developing state revenue forecasts, many state transportation agencies rely on data or forecasts produced by other state agencies or commercially available economic forecasts that many states purchase to support a variety of functions. California receives data from the California Department of Finance regarding economic growth and inflation rates, which it then applies to its own source-specific forecasts. Similarly, Florida uses economic and demographic variables developed through state estimating conferences to apply to its revenue forecasting models. A few DOTs use forecasts that are fully developed by another state agency. For example, Delaware has a statewide revenue projection committee.

Motor fuel tax is a per gallon tax in Illinois. Taxable gasoline gallonage is projected by a regression model that includes on-road MPG for auto, Illinois personal income, and the real price of gasoline as independent variables. Diesel gallonage is forecasted with a single trend line. Vehicle registration revenue

from autos/trucks is projected with separate trend-lines due to slow, steady growth.

—Illinois Department of Transportation

Revenue Forecasts for MPOs

Two-thirds of responding agencies (25 of 37 respondents) develop forecasts of federal and/or state funding for MPOs or other local and regional agencies. While not all agencies directly develop forecasts for MPO use, all but five responding DOTs report that they provide forecasts to their state MPOs. Many states also allocate obligation authority for federal funds at some substate level, though the management of this obligation authority is a critical issue as program implementation proceeds if a state is going to fully utilize available federal aid.

CASH MANAGEMENT METHODS

The method used by states for managing cash can have a direct impact on the programming process by affecting the number and total cost of the projects that can be funded in a given time period and the amount and type of financial oversight required to assume successful program delivery. Fully funding projects at the start of each project avoids the need for sophisticated cash management but may not maximize the effective use of available resources in terms of the number of projects and delivery schedule. However, using cash management to leverage available resources requires more sophisticated reporting and management and has risks if project schedules and costs are not well managed.

Cash management practices vary considerably among state transportation agencies. Most DOTs report some level of cash management and the use of some type of cash management software with tracking and forecasting capabilities. The frequency of cash monitoring varies from weekly or monthly reporting and oversight, to quarterly or annual cash management assessments and reconciliation. Obviously, in agencies that encumber the full amount of each contract as it is executed, managing cash flow is not a significant issue and doesn't require detailed oversight on a weekly or monthly basis. In contrast, agencies that manage cash flow based on actual invoices and payments to vendors, cash flow management is critical to delivering a program while effectively using all available funds. While proactive cash management approaches can accelerate projects and effectively increase the size of the program being implemented at any one time, the risks of mismanaging cash flow and having to delay or cancel contracts or default are well recognized.

Agencies are increasingly moving toward more aggressive cash management approaches. While there are a number of reasons for this trend, the primary objective is to increase the leverage available from the existing revenue and effectively increase the size of the program that can be undertaken. Some DOTs (for example, Iowa, Michigan and Illinois) have had aggressive cash flow management approaches for a number of years. Others (for example, California, Arizona) have adopted

a cash management approach that requires a minimum balance be maintained as a hedge against the uncertainty of project billing and payment cycles.

Agencies with dedicated state revenues may use state cash balances or bond issues as a float against federal receivables. Washington, for example, notes that this availability of state funds represents a big advantage in project scheduling and cash management for that agency. Many agencies are taking an aggressive approach to the management of federal reimbursements as another way to effectively increase cash flow through more frequent billing and rapid reimbursements of federal dollars. Alaska, for example, reports that they have increased their billing frequency for federal reimbursement.

Federal reimbursement is billed and received weekly so cash flow planning is instantaneous. IDOT funds construction on a cash-flow basis. Program size and implementation are planned so that target minimum balances will be achieved at year end (June 30).

—Illinois Department of Transportation

... Monthly cash forecasts of revenues and outlays are prepared by the Office of the Comptroller (six-year forecast). An annual forecast model of revenues and outlays is prepared by the Office of Management and Budget (10-year forecast). These forecasts are reconciled and reported on monthly.

... The Advanced Construction Program is used to ensure sufficient federal eligible projects for obligation purposes. Fund allocations are "constrained" to obligation ceiling levels based on ISTEA requirements and executive policy. Annual authorization and obligation plans are developed for each federal fiscal year. These plans are monitored and reported on monthly.

—Florida Department of Transportation

We have a manual federal implementation strategy that takes into account planned PE starts, planned RW starts, construction advertisements, and modifications. Goal: [to] position state to request additional authority in August of each year, and never lapse federal apportionments or authority.

—Virginia Department of Transportation

We estimate reimbursements of actual costs within the biennium and set the federal revenue cash forecast equal to that. In the past, state bond authorizations have been requested when we were more uncertain about level and timing of federal reimbursements. In some months during the year we run negative state cash balance and have to borrow via short-term notes from the State Treasurer.

... We conservatively prepare federal apportionment and obligation authority estimates based on ISTEA authorizations. Some limited use of Advance Construction (AC) and partial conversion is used currently, especially when awaiting new OA at the start of a FFY, or when OA has been used up late in the FFY. Reimbursements to contractors and the like are paid in state cash until such time we are able to convert the federally funded projects.

... Projects are either accelerated or delayed because of federal obligation controls and state expenditure controls or limits. The time of year by month determines which set of controls

tend to govern. First Quarter FFY obligation limits and Congressional inaction tend to slow down project starts late in the fall, unless the state proposes to AC the project and "funds" the project with state funds until Congress gets its work done. On the other hand, towards the end of the state fiscal year biennium a scramble occurs to match exactly the federal, state, and local apportionments with expenditures. This too, causes projects to either accelerate or slow down depending on their fund source.

—Washington State Department of Transportation

Impact of ISTEA on Cash Management

Most agencies do not find that ISTEA funding flexibility and MPO programming requirements have created problems related to cash flow management; 25 of 32 DOTs responding reported no complication in this regard. Some agencies specifically noted that they are taking advantage of the innovative financing and the advanced construction provisions of ISTEA to achieve more favorable management of both project schedules and funds.

The advanced construction provision allows an agency to start a project that is eligible for federal aid in advance of having the federal-aid apportionment or obligation authority to cover the federal share. By starting projects using advanced construction, the state is borrowing against future federal

apportionment and obligation authority levels. Incremental conversion of obligation authority, within a given federal fiscal year, allows an agency to allocate available obligation authority among a number of projects in proportion to the cash flow needs of those projects in that same fiscal year.

We use advance construction extensively to manage meeting the program schedules and incremental advance construction conversion to minimize state highway account impacts. . . .

We utilize a project management process along with a cash management process. We have been able to advance projects from future years to take advantage of savings, project delays, and new or earlier funding opportunities such as innovative financing.

—California Department of Transportation

Others noted that while these factors should be improving their cash management capacity, delays in obtaining federal approvals to use flexible funds were an impediment. Some agencies identified administrative concerns, including an increased level of required record keeping and paperwork.

Half (17) of the 34 agencies responding report that obligation authority is allocated to MPOs or to substate regions in their state; obligation authority remains held at the state level in the other 17 states.

INNOVATIVE FINANCING APPROACHES

A number of recent studies have analyzed the factors that have encouraged states to consider a whole range of innovative financing approaches in addition to the traditional user fees. Similarly, numerous studies have identified and evaluated a series of innovative financing techniques (11). The extent to which states are actually using innovative financing, the techniques most commonly cited as being used or under consideration, and the impacts, if any, of the use of innovative financing on programming decisions and procedures are the focus of this chapter.

RANGE OF TECHNIQUES

Most state transportation agencies that responded to the survey have developed some form of innovative financing: of the 39 respondents, 31 cited some initiative they had implemented; six noted programs they were in the process of developing to expand their financial capacity. Only five states reported no activity in new approaches to resource development. Since the last synthesis on programming was prepared, there has been a dramatic increase in the range of financing mechanisms being used and it is very likely that this trend will continue. This trend was also confirmed in a recent survey by the American Association of State Highway and Transportation Officials (AASHTO) (12). The primary reason is clearly the range of factors threatening traditional user fees as the only source of transportation funding. These factors include difficulty in increasing user fees at any level of government, the wider range of transportation and nontransportation uses (including deficit reduction at the national level) competing for user fee revenue, continued improvements in vehicle fleet fuel economy, development of alternative-fuel vehicles, and uncertain trends in terms of VMT and vehicle ownership growth.

Table 11 shows examples of the innovative financing sources and mechanisms being used by states responding to the survey. A number of states noted that the use of innovative financing techniques was well established before ISTEA. Ten states listed strategies for new revenue generation through public sources. Many of these mechanisms are variations on traditional revenue generating techniques, including fuel taxes and tolls. The state of Florida, for example, has recently initiated local option fuel taxes, a surcharge on rental cars, and initial registration fees for new vehicles as strategies for increasing transportation revenues. Mississippi has designated a portion of state gaming revenues for highway expenses in impacted areas. In Utah, while significant general fund surpluses recently have been allocated to transportation, they are subject to an annual appropriation and do not represent a stable long-term source of new revenue.

Bonding and toll financing have long been utilized by the state. . . . Prior to ISTEA the Illinois Department of Transportation

has developed joint projects with the Illinois State Toll Highway Authority and has extensive experience in bond financing.

—Illinois Department of Transportation

ISTEA has not impacted or initiated any new financing methods. Nevada has, prior to ISTEA, used advanced construction procedures, private and local financial participation and bonding. We plan to use all these financial sources in the future.

—Nevada Department of Transportation

In addition to the expansion of new public sector financing sources, 21 states (54 percent) reported implementing approaches for private sector participation in infrastructure development. The approaches to private funding included various forms of public/private partnerships, direct cash contributions for specific projects or to provide state/local match for federal funds, and in-kind right-of-way donations. While most private sector participation is on capital projects, a few states also noted privatization efforts for operations and maintenance. In addition, not-for-profit organizations in South Carolina have issued turnpike bonds to finance and construct roads. Some states, notably Washington, have confronted barriers to public acceptance of a broader role for the private sector.

A new funding source includes a toll bridge at the Lake of the Ozarks which was a public/private venture. Bonds were sold privately to pay for the cost of the bridge. After 30 years the Missouri Highway and Transportation Department will assume ownership of the bridge. The bridge has been designed and construction is underway. Without the help of private funding, the bridge may not have been constructed for several years.

—Missouri Department of Transportation

Illinois has utilized public-private partnerships in the Economic Development Program (EDP). This state funded program was developed to provide 50/50 funding for local access roads to new or expanding industrial businesses in Illinois. Since its inception in FY 1990, \$5 million per year has been designated for this program. Due to an increased need in FY 1997, the amount was doubled to \$10 million. Illinois uses private sector funding and contributions in the form of commercial permits for commercial driveways, large residential developments, right/left turn lanes, and signals. Construction costs for these permits range from \$20 million to \$22 million per year.

—Illinois Department of Transportation

Under legislation adopted in 1993, Washington State began a process to encourage public-private partnerships, allowing up to six demonstration projects to encourage private investment in state transportation infrastructure. The legislation allowed

TABLE 11
 INNOVATIVE FINANCING APPROACHES IMPLEMENTED BY STATE DOTs

Type of Innovation	Detailed Description	States Reporting Use		
New Revenue Sources: Public	Local option fuel taxes	Florida		
	Rental car surcharges	Florida		
	Share of state sales tax	Utah		
	Sales taxes—local	California Georgia		
	Toll revenues		California Illinois New Jersey Puerto Rico Texas	
		Admissions tax	South Carolina	
		Initial registration fees	Florida	
		Gaming revenues (designated for impact area highways)	Mississippi	
		Funding from state general fund surplus	Utah	
	New Revenue Sources: Private	Public-private partnerships	Delaware	
Florida				
Georgia				
Illinois				
Missouri				
Nevada				
North Carolina				
Puerto Rico				
Texas				
Virginia				
Private sector funding and contributions		Washington		
		Alaska		
		California		
		Hawaii		
		Illinois		
		Iowa		
		Maryland		
		Nebraska		
		New Jersey		
		Nevada		
Right-of-way donations/match		Oklahoma		
		Pennsylvania		
		Florida		
		New York		
		Pennsylvania		
		South Dakota		
		Local/Regional/State/Interagency Partnerships and Support	Joint projects with Toll Highway Authority State/local soft match	Illinois
				Nebraska
				Nevada
				Utah
Washington				
Toll credits for soft match		Kansas		
		Maryland		
		Vermont		
Some town development impact fees fund local projects City/council/local partnerships for capacity improvement projects		Montana		
		Wisconsin		
Financing Mechanisms	State Infrastructure Bank (pilot program and based on survey responses only)	California		
		Minnesota		
Loan financing		Oklahoma		
		South Carolina		
		Texas		
		Arkansas		
		Michigan		
		Florida		

TABLE 11 (Continued)

Type of Innovation	Detailed Description	States Reporting Use
Financing Mechanisms	Bond financing:	
	- Transit	California
	- Seismic	California
	- ROW	Florida
	- General	Illinois Maryland Missouri Oklahoma South Carolina Wisconsin
	Operations and maintenance subsidy	Florida
	Advanced construction/acceleration	California Florida Maryland Nebraska Nevada North Carolina Pennsylvania Wisconsin
	Interest cost subsidies and blending tax revenues and revenue bonds	Florida
	Funding from state-authorized Transportation Corporations and Transportation Development Districts	Missouri New York

private developers to make proposals to design, finance, construct and operate facilities, using tolls or other user fees to repay invested capital. Because of concerns over the level of public support for toll projects, the legislature modified the law in 1995 and 1996 to require public advisory votes in areas which might be affected [by] the imposition of tolls to support specific transportation improvements where there was demonstrated opposition to the projects. In addition, the legislature now requires that all environmental work be completed on a project prior to the vote. WSDOT is currently in the process of implementing these provisions for one project which had demonstrated opposition. In addition, a feasibility study of expanding capacity at certain park-and-ride lots is also underway. The remaining four projects originally approved under the program have either been terminated or indefinitely suspended.

—Washington State Department of Transportation

Nine states reported new arrangements with local and county governments to share the cost of locally significant projects, either through direct cash contributions or through the use of soft match mechanisms. To encourage local participation, Alaska's prioritization criteria give extra ranking points to projects with resource commitments by local government or business. Some states mention the significance of funding from other state or regional organizations, including toll authorities.

In terms of financing mechanisms, bond financing and various loan arrangements, including participation in the State Infrastructure Bank (SIB) pilot program, were the most frequently cited approaches. The SIB pilot program is designed to have federal funds provide seed money for the initial capitalization of state revolving funds to finance transportation projects. However, subsidization of interest rates and operations/maintenance costs, creation of transportation corporations

and development districts, as well as taking advantage of advance construction for federal-aid projects were also noted.

The State Infrastructure Bank (SIB) is expected to enhance the development of projects by public or private enterprise which will have a revenue source such as a toll facility or by a local tax measure. Government loan guarantees, through the use of advance capitalization, will enhance the ability to acquire loans for construction. Loans to be repaid from revenues. Loan default will be paid from the guarantees. Repayment for payments from the SIB will be repaid from revenues in future years.

—California Department of Transportation

Transportation Development Districts (TDDs), a benefit assessment district, have generated about \$3 million to date for three projects. Some R.O.W. donation is done on a corridor basis by local initiative. TDDs require state enabling legislation, and are used to advance a few projects tied to [benefit] districts. Strictly a local initiative that leverages state participation by sharing costs for local benefits of improvement.

—New York State Department of Transportation

In total, a wide range of new funding sources and mechanisms are in active use and many others are being explored. Although the majority of responding states report the use of some innovative financing, many states noted that the total dollar value of the projects funded by these mechanisms was small relative to the overall agency revenue base and financial requirements. While a few states have used many of these measures well before the passage of ISTEA, most states are still in the experimental stages of financing techniques.

Nonetheless, these new sources and mechanisms are becoming a growing and increasingly important component of state financing strategies. It should also be noted that as the use of innovative financing techniques increases, satisfying the financial constraint requirement of ISTEA can become more challenging if there is more uncertainty surrounding the revenue potential from some of these sources until specific agreements have been executed.

IMPACT ON PROGRAMMING

A number of impacts on programming from the use of innovative financing techniques were noted. Most obviously, new revenue sources and funding mechanisms have provided leverage for existing public resources or generated new resources for transportation. While in some cases these resources have been available for a wide range of improvements, in other cases they are restricted geographically (e.g., benefit districts, transportation corporations) or focused on a specific facility (e.g., tolls, right-of-way donations, etc.). In either case, more total resources are available and projects that would not have been implemented otherwise become feasible or their implementation is accelerated. While only one state specifically mentioned the fact that local participation in funding increased a project's priority, in fact a number of states advance projects more quickly or explicitly increase their priority if they are eligible for some form of innovative financing arrangement.

SCDOT is involved in several projects in various stages of development that are innovative in development and financing. Some of the revenue sources are admissions tax revenue, turnpike bonds issued by not-for-profit organizations that will finance and construct the road, and loans to projects. South Carolina is also one of the pilot states selected by FHWA for an infrastructure bank. Roads, vital to the state's economy, that could not

be completed for decades under conventional financing/construction will be constructed and in use in a matter of a few years.

—South Carolina Department of Transportation

Innovative financing has significantly enhanced the ability to program and deliver additional transportation improvements in California. These non-traditional financing mechanisms include: toll roads, bonds for transit, bonds for seismic retrofit of bridges, individual county sales tax measures for transportation purposes, and local entities may accelerate a project by using their funds and be reimbursed by the state when the project reaches its programmed year. These funding methods both result in additional funding for transportation and provide funding tools to accelerate implementation of projects.

—California Department of Transportation

Another impact on programming, particularly from mechanisms like advance construction financing and incremental conversion of obligation authority, is to accelerate project schedules and separate project implementation from the management of federal cash flow. As described in chapter 5, advanced construction allows states to start projects in advance of having the federal-aid apportionments or obligation authority to cover the federal share by borrowing against future years apportionment and obligation authority levels. Incremental conversion allows a state to allocate obligation authority available in a given federal fiscal year among a number of projects in proportion to those projects' cash flow needs in that same year. In addition, many of the private sector oriented financing options and intergovernmental options have created the need to develop and manage new partnerships. Similarly, both because of the partnerships involved, and the fact that some financing options are project specific, financing issues are becoming more integrated into the project development and design process.

CONCLUSIONS

Based on the survey of the states conducted as part of this synthesis and a review of related material, it is clear that programming practice at the state level has been undergoing a transition since the previous synthesis reports focusing on this issue about a decade ago. This transition reflects a range of factors, some of which were reinforced by the ISTEA legislation. These factors include:

- Development of stronger ties between policy and system planning and programming; establishing performance measures or benchmarks, particularly in the area of setting program goals and objectives; and, in some cases, looking at broad multimodal tradeoffs at the system level.

- Increase in the development and use of quantitative criteria for establishing goals and measuring performance, although this development is neither as comprehensive nor as widespread as might be expected. However, awareness of, and sensitivity to, the need to demonstrate more accountability is clearly increasing, whether or not quantitative measures are being used and reported. More and more states are developing some type of annual report or performance report card for both program delivery and the impact of investments on system performance.

- Emphasis on system preservation and management as reflected in program level tradeoffs and priorities and the increasing use of the asset management systems (especially pavement and bridge) to help define program-level funding and set priorities for preservation-oriented investments.

- Use of fiscally constrained programming to force key tradeoff decisions, develop more realistic short- and mid-term revenue projections, and focus resources on the set of transportation needs that are most likely to be accomplished in an environment of constrained resources environment. Obviously, subsequent to the passage of ISTEA, all states became involved in developing fiscally constrained programs, though many noted that they had adopted this approach prior to that legislation.

- Increased focus on multimodal issues and tradeoffs, although in most states these are addressed at the policy or system planning level rather than in programming. The predominant approach continues to be to set priorities and funding levels at the program level and project priorities within mode-specific categories. While there are exceptions, significant barriers to multimodal programming exist, including institutional and funding constraints at the state level, continued differences in the administration of modal programs at the federal level, and continued need for more effective technical tools and data to support multimodal analysis within reasonable resource constraints.

- Increased use of innovative financing and aggressive cash flow management approaches to stretch and leverage

available public resources as far as possible. The increasing availability of a wider range of financing methods and increased flexibility in the approaches to managing federal reimbursement were viewed as significant positive developments.

- A broader set of partners involved in programming decisions reflects the changing role of the MPOs, the need to develop fiscally constrained programs involving negotiations with a wide set of actors, the increased use of innovative financing or cash management techniques requiring new cooperation and partnerships with other public agencies and private parties, and more comprehensive public involvement efforts as part of the programming process.

In addition to these overall observations, a number of more specific conclusions are summarized below.

Influence of ISTEA and Other Factors

The overall reaction to ISTEA programming requirements was positive and no specific requirement was widely viewed as difficult to respond to. The requirement for fiscally constrained programs was viewed as having the most significant impact on programming. The fiscal constraint's influence on forcing priority decisions and more realistic programs was generally viewed positively, though more flexibility to deal with program changes was desired. The integration of the STIP/TIP documents also had a significant impact in terms of program administration. Reaction here varied more widely in terms of the usefulness of the effort required to consolidate documents. Funding flexibility and the stronger role for MPOs were generally viewed to have a smaller impact on programming.

- In some states new legislation had changed the institutional structure, procedures, or resources available for programming, but there is no strong trend overall. For example, legislation in Washington revised that state's program structure and procedures, and in Wyoming the state highway department and other agencies were consolidated into a department of transportation. In terms of environmental issues, compliance with wetlands regulations was the issue cited most often as a challenge and an issue present in more than three-quarters of responding states. In contrast, air quality regulations are affecting fewer states. The impact of a variety of mitigation measures on project costs was noted by many states as another factor stretching available resources.

- While many states recognize the risk associated with weather or natural disaster events, there is a general view that existing reserve or relief funds, federal disaster relief, and ongoing mitigation efforts (e.g., seismic retrofit, rerouting off of flood plains, etc.) were sufficient to manage the risk effectively. In

contrast, uncertainty associated with federal funding (especially toward the end of an authorization period) and, in some cases, state funding as well as unanticipated project cost and schedule changes were viewed as having a more significant impact on programming.

Priority Setting

- More than 80 percent of states responding to the survey are using some quantitative criteria to establish program goals or measure performance, or both. However, the use of such criteria is not comprehensive in most states and generally does not reflect multimodal (as opposed to mode-specific) criteria. As mentioned above, many states address multimodal concerns and tradeoffs in system or policy planning efforts and have mode-specific programming approaches. The criteria most widely used reflect system physical conditions (i.e., pavement and bridge ratings) as opposed to system service levels, although many states do use some traffic level-of-service and safety indicators as well.

- Sufficiency and deficiency rating methods continue to be widely used as priority-setting tools for a broad range of program areas. Benefit-cost techniques are primarily used for safety improvements although 13 states reported applying these techniques to a broad range of highway improvements or major highway capacity improvements. Cost effectiveness or other rating factors are used by a variety of states as well. While the extent to which quantitative methods are used for priority setting varies considerably among the responding states, only two states did not report the use of any quantitative method at all. Several states noted their use of professional judgment and a range of qualitative factors in their prioritization process, often within the context of some statewide guidelines on needs and general program-level priorities.

- The pavement and bridge management systems are being used by about 60 percent of the states surveyed to help set preservation project priorities for these program categories.

- Two states are moving toward a more decentralized approach to identifying projects and setting priorities based heavily on criteria and approaches developed at the substate level.

Use of Management Systems

- While most agencies now have some management systems in place, use of these systems is largely limited to the collection and management of inspectional data and identification and prioritization of potential projects.

- Management systems for pavements and bridges are by far the most widespread implementation.

- Use of management systems as tools for more strategic decision making—such as setting program goals, establishing program investment levels, performance evaluation, and balancing investments in capital versus maintenance—is relatively low, in use by about 60 percent or less of the states responding to the survey, depending on the specific management system.

- Some agencies are cautious about the use of management systems due to a concern that technical rankings will supersede engineering judgment and executive policy direction in the development of program goals.

- Problems with systems integration, acquisition of sufficient historic data, and staff expertise in the use of these systems are technical issues that have hampered agencies in using management systems to their fullest capacity.

- With the change in ISTEA requirements for agencies to implement management systems, it is likely that many agencies will select specific management systems based on the composition of their transportation system and their perception of the usefulness of each system relative to the cost of investment. Few states appear to be committed to implementation of a comprehensive and integrated set of management systems.

Program Tradeoffs

- Most agencies (over two-thirds) take a mode-specific approach to identifying and prioritizing projects, and to evaluating performance.

- The degree to which agencies are focused on an intermodal approach to solving transportation problems varies widely. Few agencies take a systems approach to developing program goals or use mobility criteria.

- Overall, the most dominant approach to goal setting focuses on infrastructure conditions and most agencies give priority to their system preservation needs.

- The degree to which state resources are available for transportation investments has a significant effect on how agencies approach programming and tradeoffs among programs. Agencies with state revenues sufficient to more than match available federal aid have more flexibility to give priority to projects that are not eligible for federal aid and to manage project scheduling to maximize the use of federal funds and achieve efficient project delivery.

- Few agencies rigorously evaluate the tradeoff between maintenance versus capital system preservation expenditures as part of the programming process.

Financing

- The funding flexibility provided by ISTEA has proven useful to many states. Most commonly mentioned were the use of Advanced Construction funds to leverage funds and expedite project delivery. Agencies with constraints on the flexibility of state revenues, a perception of significant unmet needs in every program category, or with revenues just sufficient to match federal aid were less able to take advantage of flexible funding provisions.

- Eighty-seven percent of responding agencies are experimenting with different sources of revenue on a state level, including the use of new fees and taxes. There is an increasing emphasis on local matches for local or regionally significant projects. These matches include both in-kind donations (such as rights-of-way) and cash contributions for both capital and

maintenance expenses. Some agencies are involved in project financing approaches that include new partnerships with private developers or other private sector groups involving the financing and, in some cases, the implementation and operation of transportation facilities.

- While the overall financial impact of innovative financing approaches still represents a relatively small percentage of states' total transportation revenue base, agencies are aggressively experimenting with a wide range of methods for leveraging existing public revenues.

Performance Measures

The use of performance measures as a means of informing program goals and objectives is not widespread. There is a need to build better connections between agencies' planning and programming processes to achieve this feedback loop to the planning process. A stronger relationship between program evaluation and program goal setting can achieve:

- Better accountability to state legislatures, users, and the general public;
- Clearer and more "transparent" guidelines for making sound and cost-effective investment choices; and
- Improved management tools for measuring agency progress in program delivery.

Future Directions

The objective of the synthesis is to document the current state of the practice. For a topic such as programming, it is expected that the basic approach and technical support tools used will vary widely from state to state. Much of this variation reflects differences in the nature and complexity of the problems faced, institutional arrangements, funding structures, and other factors. No one overall approach to programming will meet the needs of all state DOTs. However, notwithstanding this variation in practice, some agencies are taking steps that may be worth additional consideration by DOTs in other states. These steps include:

- The establishment of some quantitative and output-oriented program objectives and performance measures is giving some agencies a stronger basis for establishing expectations, monitoring performance, and communicating results.

- Use of specific priority criteria for project selection, including some quantitative criteria, is widespread though not universal. While no agency suggests a strictly mechanical or technical approach can be used to make what are essentially policy and political choices, explicit criteria can be helpful in establishing the relative merits of projects and providing a framework for project selection.

- Use of cost-benefit, cost-effective techniques and optimization tools is fairly widespread, particularly in some program categories (e.g., safety). These tools seem to offer a more rigorous and analytic approach for evaluating projects and program-level tradeoffs. Again, while these tools can "automate" the decision-making process, a number of agencies use them to provide consistent information on competing projects.

- Explicit consideration of program-level tradeoffs (both among modes and types of work) appears to be increasing. As funding flexibility increases, the need for explicit approaches for evaluating program-level tradeoffs is likely to increase as well. The management systems and some cost-benefit and optimization methods can provide technical support to this process.

- State DOTs clearly recognize two basic types of uncertainty confronting their programs. One type is dealing with project costs, schedules, and funding over which they have some control. The second is related to weather and natural disasters over which there is no control. At least for the first category of uncertainty, and possibly for the second, more formal risk assessment procedures may be useful. Such techniques can help both assess the impacts of different events and provide a way to measure the value of contingency planning.

- More sophisticated cash management is becoming an important part of many states' program delivery process. Where possible (i.e., not prohibited by state laws), cash management can leverage existing funds and accelerate project delivery schedules.

REFERENCES

1. Neumann, L.A., F.D. Harrison, and K. Sinha, *Transportation Research Circular 406: Transportation Planning, Programming, and Finance: Proceedings of a Conference*, Transportation Research Board, National Research Council, Washington, D.C. (April 1993).
2. Humphrey, T.F., *NCHRP Synthesis 217: Consideration of the 15 Factors in the Metropolitan Planning Process*, Transportation Research Board, National Research Council, Washington, D.C. (1995).
3. AASHTO Standing Committee Task Force on Management Systems, *Report on Survey of Management Systems Use* (June 1996).
4. "The TMS Toolbox: Update on the Transportation Management System of the Michigan Department of Transportation," Volume 1, Number 2, Michigan Department of Transportation (April 1996).
5. *Transportation Research Circular 465: Conference on Transportation Programming Methods and Issues*, December 1996, Transportation Research Board, National Research Council, Washington, D.C.
6. Rutherford, G.S., *NCHRP Synthesis 201: Multimodal Evaluation in Passenger Transportation*, Transportation Research Board, National Research Council, Washington, D.C. (1994).
7. Metropolitan Transportation Commission (MTC), Oakland, California, *1995 Multimodal Project Application* (September 1995).
8. Vermont Agency of Transportation, Systems Planning Group, *Public Involvement per 23 CFR 450.212(f)* (March 3, 1995).
9. Mickelson, L.R., AICP, *Idaho User Friendly STIP*, prepared for Transportation Research Board Conference on Transportation Programming Methods and Issues, Irvine, California (December 3-6, 1995).
10. Platt, J., *Public Involvement in Program Development and Delivery*, prepared for Transportation Research Board Conference on Transportation Programming Methods and Issues, Irvine, California (December 3-6, 1995).
11. Balloffet and Associates, Inc., "Public Involvement: Wisconsin Statewide Transportation Planning Process," *Examples of Statewide Transportation Planning Practices*, prepared for U.S. Department of Transportation, Federal Highway Administration and Federal Transit Administration (December 20, 1994).
12. Reno, A.T. and J.R. Stowers, *NCHRP Report 377: Alternatives to Motor Fuel Taxes for Financing Surface Transportation Improvements*, Transportation Research Board, National Research Council, Washington, D.C. (1995).
13. Clawson, D., "Innovative Transportation Financing: A Report on the Results of a National Survey by the American Association of State Highway and Transportation Officials," AASHTO, unpublished (April 1995).
14. *Programming and Prioritization Study*, Washington State Legislature Transportation Committee, prepared by Cambridge Systematics, Inc. with Wilbur Smith Associates (January 1992).

BIBLIOGRAPHY

- Campbell, B., *NCHRP Synthesis 48: Priority Programming and Project Selection*, Transportation Research Board, National Research Council, Washington, D.C. (1978).
- Byrd, L., *NCHRP Synthesis 6: Principles of Project Scheduling and Monitoring*, Transportation Research Board, National Research Council, Washington, D.C. (1970).
- Humphrey, T.F., *NCHRP Synthesis 72: Transportation Needs Studies and Financial Constraints*, Transportation Research Board, National Research Council, Washington, D.C. (1980).
- Cambridge Systematics, Inc., FHWA Financing in ISTEA, Final Report, FHWA Task Order A-94-04 (November 1995).
- Covil, James L., P.E., (Wilbur Smith Associates), Statewide Planning as a Framework for Programming Decisions, presentation materials for Transportation Research Board Conference on Transportation Programming Methods and Issues, Irvine, California (December 3-6, 1995).
- Humphrey, T.F., *NCHRP Synthesis 84: Evaluation Criteria and Priority Setting for State Highway Programs*. TRB, National Research Council, Washington, D.C. (1981).
- JHK & Associates, Pima Association of Governments Transportation Improvement Program: Proposed Roadway Project Assessment and Prioritization Procedure, prepared for Pima Associations of Governments Transportation Planning Division (October 1995).
- Jiang, Yi and K.C. Sinha, Approach to Combine Ranking and Optimization Techniques in Highway Project Selection, *Transportation Research Record 1262*, TRB, National Research Council, Washington, D.C. (1990).
- Larson, T.D. and K. Rao, *NCHRP Synthesis 151: Process for Recapitalizing Highway Transportation Systems*, Transportation Research Board, National Research Council, Washington, D.C. (1989).
- Rao, K. and T.D. Larson, U.S. Highway Capital Programs: Elements of Dynamics and Innovation, *Transportation Research Record 1262*, TRB, National Research Council, Washington, D.C. (1990).
- Stuart, D.G., (Chicago Transit Authority), Goal-Setting and Performance Measurement in Transportation Planning/Programming, prepared for Transportation Research Board Conference on Transportation Programming Methods and Issues, Irvine, California (December 1995).
- Transportation Research Board, Highway Programming Issues and Practices: Proceedings of Two Conferences, Final Report, prepared for FHWA, DOT-1-84-05 (May 1983).
- Weisbrod, G.E. and J. Beckwith, Measuring Economic Development Benefits for Highway Decision Making in Wisconsin, *Transportation Research Record 1262*, TRB, National Research Council, Washington, D.C. (1990).

GLOSSARY

AASHTO—American Association of State Highway and
Transportation Officials

AC—Advanced Construction

ADT—Average Daily Traffic

ATIP—Area Transportation Improvement Program

ATP—Area Transportation Partnership

BMS—Bridge Management System

CAA—Clean Air Act

Caltrans—California Department of Transportation

CMA—Congestion Management Agency

CMAQ—Congestion Mitigation and Air Quality

CMS—Congestion Management System

CPMS—Capital Program Management System

CWA—Clean Water Act

DNR—Department of Natural Resources

DOT—Department of Transportation

EDP—Economic Development Program

EPA—Environmental Protection Agency

FDOT—Florida Department of Transportation

FFY—Federal Fiscal Year

FHWA—Federal Highway Administration

FTA—Federal Transit Administration

HOV—High Occupancy Vehicle

IDOT—Illinois Department of Transportation

IRI—International Roughness Index

ISTEA—Intermodal Surface Transportation Efficiency Act

ITD—Idaho Transportation Department

KDOT—Kansas Department of Transportation

MDOT—Michigan Department of Transportation

MHTD—Missouri Highway and Transportation
Department

MN/DOT—Minnesota Department of Transportation

MIS—Major Investment Study

MPO—Metropolitan Planning Organization

MTC—Metropolitan Transportation Commission

NAAQS—National Ambient Air Quality Standard

NCHRP—National Cooperative Highway Research Program

NDOT—Nevada Department of Transportation

NHS—National Highway System

NPDES—National Pollutant Discharge Elimination System

NYSDOT—New York State Department of Transportation

OA—Obligation Authority

PSC—Pavement Structural Condition

PennDOT—Pennsylvania Department of Transportation

PMS—Pavement Management System

ROW—Right of Way

RQFS—Road Quality Forecasting System

RTPA—Regional Transportation Planning Agency

SCDOT—South Carolina Department of Transportation

SIB—State Infrastructure Bank

SLRP—State Long Range Plan

SMS—Safety Management System

SMTP—Statewide Multimodal Transportation Plan

SSMMP—Silver State Mobility Management Program

STIP—State Transportation Improvement Program

STP—Surface Transportation Program

TDD—Transportation Development District

TIP—Transportation Improvement Program

TMA—Transportation Management Area

TMS—Transportation Management System

TPP—Transportation Policy Plan

TRAAK—Trails and Recreational Access for Alaska

TRB—Transportation Research Board

VMT—Vehicle-Miles Traveled

WSDOT—Washington State Department of Transportation

APPENDIX A

Questionnaire

NCHRP Project 20-5, Topic 27-09

Methods for Capital Programming and Project Scheduling

Name of State: _____

Name of Respondent: _____

Title of Respondent: _____

Phone and fax numbers: _____

Date: _____

KEY INFLUENCES ON PROGRAMMING

1. **ISTEA Programming Requirements:** how have the following ISTEA programming related requirements affected programming and project scheduling? Please rank order (1-5, with 1 denoting the most influence) the five requirements with respect to their impact on programming and project scheduling. We recognize that some of these requirements may change with the next reauthorization but we are interested in response based on current ISTEA requirements.

- Expanded role for MPOs in programming (Level of Impact #___)

- Funding flexibility (Level of Impact #___)

- Financially constrained STIP/TIP (Level of Impact #___)

- Integration of STIP/TIP documents (Level of Impact #___)

- ISTEA planning factors (Level of Impact #___)

2. **State Legislation:** have there been any recent changes to state legislation that have had a significant impact on programming? If yes, what is the nature of these legislative changes?

3. **Environmental Regulations:** what has been the impact of federal or state environmental regulations on capital program and project scheduling?

- Air Quality

- Noise

- Wetlands

- Water Quality

- Other

4. **Financing Methods:** have any new financing methods or funding sources (including private funding or public/private partnerships) been established which have had a significant impact on programming? What sources/methods? What has been the impact? _____

5. **Uncertainties:** which of the following factors have had a significant effect on programming decisions and project scheduling? What steps have been taken to anticipate or account for these uncertainties?

- Natural disasters

- Weather

- Changes in project cost/schedules

- Federal/state funding

- Other

PROGRAMMING AND PROJECT SELECTION METHODS

1. Priority Setting Tools

- Are quantifiable measures used to define program objectives or system performance measures (i.e. measures of the program's impact on facility condition or service)? If yes, what measures are used?

- Are threshold criteria used to limit the number and type of projects that are formally evaluated and prioritized? If yes, what type of thresholds used?

- What specific quantitative priority methods are used and for what type of programs or projects (i.e. bridge, preservation, system management/operation, capacity etc.). If you use more than one of these methods, which do you rely on most for programming and project selection? Why?

- Benefit/cost analysis _____
- Cost/effectiveness _____
- Sufficiency/deficiency ratings _____
- Other priority ratings or index _____
- Management systems _____
- Other _____

(If written documentation of any of these methods is available, we would appreciate receiving a copy along with the questionnaire.)

2. Management Systems

- Please identify which, if any, management systems (whether or not they meet ISTEA requirements) are used to assist in the following areas:

- Develop program goals (i.e., desired system condition or service levels)?

- Establish program funding levels?

- Identify specific projects and set project priorities?

- If management systems are not being used as a tool to support program and project decision-making, what are the key barriers/limitations of these systems?

- Are any of the management systems used to help establish the funding levels for maintenance vs. capital funding? If yes, which systems?

3. Multimodal Tradeoffs

- Are multimodal goals being explicitly defined and used to set program directions?

- Are mode-specific criteria used to set priorities within each mode or are multimodal criteria used to compare projects across modes?

- How are multimodal tradeoffs made?

4. Program Tradeoffs

- How are tradeoffs among programs/project categories made (i.e. preservation vs. new capacity etc.)?

- What is the connection between the capital and maintenance budgets?

- What performance measures and evaluation methods are used to assess program effectiveness in achieving the organization's goals?

5. Public Involvement

- What mechanisms for public input are used during the programming process?

FINANCING AND CASH MANAGEMENT

1. Revenue Forecasting

- What methods are used to forecast federal funds beyond the current authorization act?

- What assumptions are used for the obligation ceiling in future years?

- What methods are used to forecast state funds from different revenue sources?

- Are federal/state funding forecasts developed for MPOs or other sub-state regions?

- Are federal/state funding forecasts provided to MPOs?

- Have the ISTEA requirements for fiscally constrained STIP/TIP changed how revenue forecasts are prepared or created any significant problems?

2. Innovative Financing

- Are any non-traditional revenue sources being used to fund the state transportation program? If yes, what sources?

- Has the use of these sources or the need to forecast likely revenue from these sources created problems?

3. Cash Management Methods

- What methods are used to manage cash flow and deal with the following issues:

- Federal and state fund balances

- Authorization levels and obligation ceilings

- Changes to project schedules/costs

- Other

- Have ISTEA funding flexibility or MPO programming requirements created any problems in managing cash flow?

- Is obligation authority allocated to MPOs or sub state regions?

ADDITIONAL COMMENTS

- Please comment on any other aspects of your programming and project scheduling processes that you think are worth noting for this survey. Submission of relevant documents will be appreciated.

Completed questionnaires should be returned to:

Lance A. Neumann
Cambridge Systematics, Inc.
150 Cambridge Park Drive, Suite 4000
Cambridge, MA 02140

THANK YOU FOR YOUR ASSISTANCE!

APPENDIX B

SURVEY RESPONDENTS

Alabama Department of Transportation
Transportation Planning
1409 Coliseum Boulevard
Montgomery, AL 36130

Alaska Department of Transportation
Division of Statewide Planning
3132 Channel Drive
Room 200
Juneau, AK 99801-7898

Arizona Department of Transportation
Transportation Planning Division
206 S. 17th Avenue, Room 300B
Phoenix, AZ 85007

Arkansas State Highway & Transportation Department
Engineering/Planning Division
10324 Interstate 30
P.O. Box 2261
Little Rock, AR 72203

California Department of Transportation
Transportation Planning
1120 N. Street
P.O. Box 942673
Sacramento, CA 94273-0001

Connecticut Department of Transportation
Bureau of Policy and Planning
2800 Berlin Turnpike
P.O. Box 317546
Newington, CT 06131-7546

Delaware Department of Transportation
Bay Road, Route 113
P.O. Box 778
Dover, DE 19903

Florida Department of Transportation
Office of Transportation Planning
605 Suwannee Street
Tallahassee, FL 32399-0450

Georgia Department of Transportation
Planning & Programming
2 Capitol Square
Atlanta, GA 30334

Hawaii Department of Transportation
Highways Division
869 Punchbowl Street
Honolulu, HI 96813-5097

Illinois Department of Transportation
Office of Planning & Programming
2300 S. Dirksen Parkway
Springfield, IL 62764

Iowa Department of Transportation
Office of Program Management
800 Lincoln Way
Ames, IA 50010

Kansas Department of Transportation
Division of Planning & Development
Docking State Office Building
Topeka, KS 66612-1568

Kentucky Department of Transportation
State Highways
State Office Building
501 High Street
MS 9-7
Frankfort, KY 40622

Maryland Department of Transportation
Office of Planning & Preliminary Engineering
707 N. Calvert Street
Baltimore, MD 21202

Michigan Department of Transportation
Bureau of Transportation Planning
425 West Ottawa Street
P.O. Box 30050
Lansing, MI 48909

Minnesota Department of Transportation
Office of Investment Management
395 John Ireland Boulevard
MS 140, Room 211
St. Paul, MN 55155

Mississippi Department of Transportation
Preconstruction
500 N. West Street
P.O. Box 1850
Jackson, MS 39215-1850

Missouri Highway & Transportation Department
Planning Office
Corner of Capitol & Jefferson
Box 270
Jefferson City, MO 65102

Montana Department of Transportation
Transportation Planning Division

2701 Prospect Avenue
P.O. Box 201001
Helena, MT 59620-1001

Nebraska Department of Roads
Transportation Planning Division
1500 Nebraska Highway 2
P.O. Box 94759
Lincoln, NE 68509-4759

Nevada Department of Transportation
Planning & Program Development
1263 S. Stewart Street
Carson City, NV 89712

New Jersey State Department of Transportation
Capital Program Control & Support Services
1035 Parkway Avenue
CN600
Trenton, NJ 08625

New York State Department of Transportation
Planning & Program Management
State Office Campus, Building 5
Albany, NY 12232

North Carolina Department of Transportation
Division of Highways Program Analysis Unit
15 Wilmington Street
P.O. Box 25201
Raleigh, NC 27611

North Dakota Department of Transportation
Program and Project Development
608 East Boulevard Avenue
Bismark, ND 58505-0700

Oklahoma Department of Transportation
Programs Division
200 N.E. 21st Street
Oklahoma City, OK 73105-3204

Pennsylvania Department of Transportation
Center for Program Development and Management
Transportation & Safety Building
Room 918
Harrisburg, PA 17120

Puerto Rico Highway and Transportation Authority
Planning Office
South Building
Minillas Government Center
15th Floor DeDiego Avenue
Santurce, P.R. 00940

South Carolina Department of Highways & Public
Transportation

Office of Planning
Silas N. Pearman Building
955 Park Street
P.O. Box 191
Columbia, SC 29202

South Dakota Department of Transportation
Planning & Programs
700 E. Broadway Avenue
Pierre, SD 57501-2586

Texas Department of Transportation
Transportation Planning and Programming Division
P.O. Box 5051
Austin, TX 78763-5051

Utah Department of Transportation
Program Division
4501 South 2700 West
Salt Lake City, UT 84119

Vermont Agency of Transportation
Systems Planning
State Administration Building
133 State Street
Montpelier, VT 05633-5001

Virginia Department of Transportation
Programming and Scheduling
1401 East Broad Street
Richmond, VA 23219

Washington State Department of Transportation
Program Management
Transportation Building, KF-01
Jefferson St. at Maple Park
Olympia, WA 98504-7300

West Virginia Department of Transportation
Project Control Division
Division of Highways
1900 Kanawha Blvd., Building 5
Room 916
East Charleston, WV 25305-0440

Wisconsin Department of Transportation
Program Development and Analysis
State Transportation Building
4802 Sheboygan Avenue
P.O. Box 7910
Madison, WI 53707-7910

Wyoming Department of Transportation
Transportation Planning
5300 Bishop Boulevard
P.O. Box 1708
Cheyenne, WY 82003-1708

APPENDIX C

Responses of State DOTs to Selected Questions

The following tables provide specific state DOT responses to four of the survey questions regarding programming and project selection methods. These tables are based solely on the information provided in the questionnaire responses received from this study and may therefore not contain complete information on the current activities of any of the participating agencies.

TABLE C-1

Question: Are quantifiable measures used to define program objectives or system performance measures (i.e., measures of the program's impact on facility condition or service)? If yes, what measures are used?

	Yes	Partial	Under Development	No	No Response	Different Regional Processes
AL				X		
AK	X					
AZ			X			
AR	X					
CA	X					
CT	X					
DE	X		X			
FL	X					
GA	X					
HI			X			
IL	X					
IA	X					
KS		X				
KY		X				
MD	X					
MI	X					
MN						X
MS				X		
MO					X	
MT	X					
NE	X					
NV	X					
NJ			X			
NY	X					
NC	X					
ND				X		
OK	X		X			
PA	X					
PR	X					
SC				X		
SD	X					
TX	X					
UT	X					
VT	X					
VA				X		
WA	X					
WV	X					
WI	X					
WY					X	
Totals	26	2	5	5	2	1

TABLE C-2

Condition Measures						Total States: 21
	System Condition Ratings	Bridge Safety and Condition Ratings	Sufficiency/Deficiency Ratings	Pavement Management/Condition Measures	Maintenance Condition Survey	Rail Sufficiency Ratings, Conditions
AL						
AK		X		X		
AZ						
AR	X	X	X			
CA						
CT		X		X		
DE						
FL		X	X	X	X	
GA	X	X	X	X		
HI						
IL		X		X		
IA		X	X	X		
KS						
KY						
MD	X	X				
MI	X	X	X	X		
MN						
MS						
MO						
MT			X	X		
NE				X		
NV						
NJ						
NY		X		X		
NC						
ND						
OK				X		
PA		X	X	X		
PR						
SC						
SD	X	X		X		
TX		X	X	X		
UT		X	X	X		
VT		X	X	X		X
VA		X	X	X		X
WA						
WV		X	X	X		
WI		X		X		
WY						
Totals	5	18	12	20	1	2

TABLE C-2

Capacity Measures			Total States: 10	Safety Measures		Total States: 6
ADT/Traffic Counts and Forecasts	Congestion	Volume/Capacity/Level of Service		Accident Frequency		Safety
AL						
AK		X				
AZ						
AR	X					
CA						
CT						
DE						
FL						
GA		X	X			X
HI						
IL		X				X
IA						
KS						
KY						
MD		X				X
MI						
MN						
MS						
MO						
MT		X				X
NE						
NV						
NJ						
NY		X				
NC	X					
ND						
OK	X	X		X		X
PA				X		
PR						
SC						
SD						
TX						
UT						
VT						
VA						
WA						
WV						
WI		X				
WY						
Totals	3	3	6	2	4	

TABLE C-2

Cost/Benefit Measures	Total States: 5	Needs Prioritization Measures		Total States: 2
Cost/Benefit; Value/Cost		Funding/Priority Formulas		Relational Evaluation of State Needs
AL				
AK	X			
AZ				
AR				
CA				
CT				
DE				
FL				
GA	X			
HI				
IL				
IA				
KS		X		
KY	X			X
MD				
MI				
MN				
MS				
MO				
MT				
NE				
NV	X			
NJ				
NY				
NC	X			
ND				
OK				
PA				
PR				
SC				
SD				
TX				
UT				
VT				
VA				
WA				
WV				
WI				
WY				
Totals	5	1	1	

TABLE C-2

Strategic/Economic Impact Measures				Total States: 5
	Strategic Planning Objectives	State Statute Priorities	Community Goals	Economic Development
AL				
AK				
AZ				
AR				
CA		X		
CT				
DE	X			
FL				
GA	X			
HI				
IL				
IA				
KS				
KY				
MD				X
MI				
MN				
MS				
MO				
MT				
NE				
NV				
NJ				
NY				
NC			X	
ND				
OK				
PA				
PR				
SC				
SD				
TX				
UT				
VT				
VA				
WA				
WV				
WI				
WY				
Totals	2	1	1	1

TABLE C-2

Environmental Measures			Total States: 2
	Environmental Needs	Conformity	Land Use
AL			
AK			
AZ			
AR			
CA			
CT			
DE			
FL			
GA			
HI			
IL			
IA			
KS			
KY			
MD	X	X	
MI			
MN			
MS			
MO			
MT			
NE			
NV			
NJ			
NY			
NC			X
ND			
OK			
PA			
PR			
SC			
SD			
TX			
UT			
VT			
VA			
WA			
WV			
WI			
WY			
Totals	1	1	1

TABLE C-2

Productivity/Delivery Measures			Total States: 2
	Kilometers of Road Built/Resurfaced	Number of New Bridges	Annual Report
AL			
AK			
AZ			
AR			
CA			
CT			
DE			
FL			X
GA			
HI			
IL			
IA			
KS			
KY			
MD			
MI			
MN			
MS			
MO			
MT			
NE			
NV			
NJ			
NY			
NC			
ND			
OK			
PA			
PR	X	X	
SC			
SD			
TX			
UT			
VT			
VA			
WA			
WV			
WI			
WY			
Totals	1	1	1

TABLE C-3

Question: What specific quantitative priority methods are used and for what type of programs or projects (i.e., bridge, preservation, system management/operation, capacity, etc.)?

Benefit/Cost Analysis											Total States: 26
	Project General Selection	Safety Programs	Project Evaluation	Operations	Major Projects	Highway Programs	Development	Congestion Management	Construction versus Rehabilitation	Value Engineering	Fish Barrier Removal
AL											
AK											
AZ											
AR		X									
CA	X										
CT		X									
DE				X							
FL		X									
GA		X				X					
HI	X										
IL											
IA					X						
KS		X									
KY		X									
MD		X		X	X						
MI											
MN											
MS									X		
MO											
MT		X									
NE		X									
NV		X									
NJ		X									

TABLE C-3

Benefit/Cost Analysis											Total States: 26
	Project General Selection	Safety Programs	Project Evaluation	Operations	Major Projects	Highway Programs	Development	Congestion Management	Construction versus Rehabilitation	Value Engineering	Fish Barrier Removal
NY		X									
NC						X					
ND											
OK						X					
PA											
PR											
SC											
SD					X		X				
TX											
UT		X									
VT		X	X								
VA		X									
WA		X						X			X
WV											
WI		X			X	X					
WY										X	
Total	2	4	13	1	2	4	4	1	1	1	1

TABLE C-3

Cost-Effectiveness Measures											Total States: 21
	Design General Studies	Operations	Major Projects	Safety Programs	Project Evaluation	Pavement Programs	Highway Projects	Bridge Management	Value Engineering	Feasibility Study	Maintenance
AL											
AK						X					
AZ						X					
AR											
CA											
CT	X										
DE		X									
FL											
GA							X	X			
HI	X										
IL										X	
IA											
KS											
KY											
MD			X								
MI						X					
MN	X										
MS				X							
MO											
MT			X				X				
NE	X										
NV											
NJ											

TABLE C-3

Cost-Effectiveness Measures											Total States: 21
	Design General Studies	Operations	Major Projects	Safety Programs	Project Evaluation	Pavement Programs	Highway Projects	Bridge Management	Value Engineering	Feasibility Study	Maintenance
NY						X					
NC											
ND											
OK											
PA											
PR											
SC											
SD						X		X			
TX	X										
UT									X		
VT				X	X						
VA											
WA	X										
WV											
WI				X							
WY											X
Total	5	1	1	2	3	1	5	2	2	1	1

TABLE C-3

Sufficiency/Deficiency Ratings								Total States: 29
General	Bridge Ratings	Safety Ratings	Project Evaluation	Pavement Ratings	Major Projects	SLOSS Ratings	Traffic Ratings	
AL								
AK				X				
AZ								
AR		X					X	
CA		X						
CT		X		X		X		
DE		X		X				
FL		X		X				
GA		X		X				
HI	X							
IL								
IA					X			
KS								
KY		X						
MD		X		X				
MI				X				
MN				X				
MS		X						
MO								
MT		X			X			
NE	X							
NV								
NJ								

TABLE C-3

Sufficiency/Deficiency Ratings								Total States: 29
General	Bridge Ratings	Safety Ratings	Project Evaluation	Pavement Ratings	Major Projects	SLOSS Ratings	Traffic Ratings	
NY	X			X				
NC	X			X				
ND	X							
OK	X			X				
PA	X			X				
PR								
SC								
SD	X			X				
TX	X							
UT	X							
VT		X	X					
VA	X							
WA	X							
WV	X			X				
WI								
WY				X				
Total	2	21	1	1	15	2	1	

TABLE C-3

Other Priority Ratings													Total States: 22	
	Project General Evaluation	Safety Programs	Pavement Programs	Bridge Programs	Highway Programs	Maintenance Cost	Intermodal Programs	Congestion Management	Economic Benefit	Value/ Cost	Traffic	Planning Factors	Accident Records	
AL														
AK		X					X		X					
AZ											X			
AR		X												
CA	X													
CT			X											
DE													X	
FL														
GA		X												
HI														
IL			X	X										
IA														
KS				X	X									
KY													X	
MD														
MI		X				X					X			
MN														
MS				X										
MO														
MT														
NE	X													
NV														
NJ														

TABLE C-3

Other Priority Ratings													Total States: 22	
	Project General Evaluation	Safety Programs	Pavement Programs	Bridge Programs	Highway Programs	Maintenance Cost	Intermodal Programs	Congestion Management	Economic Benefit	Value/ Cost	Traffic	Planning Factors	Accident Records	
NY								X						
NC														
ND														
OK														
PA													X	
PR				X										
SC									X	X			X	
SD		X												
TX														
UT													X	
VT	X	X												
VA			X											
WA														
WV														
WI														
WY			X	X										
Total	2	1	6	4	5	1	1	1	1	1	3	3	2	

TABLE C-4

Question: Please identify which, if any, management systems (whether or not they meet ISTEA requirements) are used to assist in the following areas:

- Develop program goals (i.e., desired system condition or service levels)?
- Establish program funding levels?
- Identify specific projects and set project priorities?

Currently Use Management Systems											Total States Reporting Use: 38
	Bridge Mgmt. System	Pavement Mgmt. System	Safety Mgmt. System	Congestion Mgmt. System	Maintenance Mgmt. System	Program Mgmt. System	Traffic Monitoring Mgmt. System	Public Transit Mgmt. System	Highway Mgmt. System	Intermodal Mgmt. System	Drainage Mgmt. System
AL	X	X	X		X						
AK	X	X	X					X			
AZ	X	X	X								
AR	X	X	X								
CA	X	X									
CT	X	X									
DE	X	X									
FL	X	X	X	X						X	
GA	X	X									
HI		X									
IL	X	X									
IA	X	X									
KS	X	X		X					X		
KY	X	X									
MD	X	X									
MI		X							X		
MN	X	X	X								
MS		X									
MO						X	X				
MT			X						X		
NE		X							X		
NV											

TABLE C-4

Currently Use Management Systems											Total States: 38
	Bridge Mgmt. System	Pavement Mgmt. System	Safety Mgmt. System	Congestion Mgmt. System	Maintenance Mgmt. System	Program Mgmt. System	Traffic Monitoring Mgmt. System	Public Transit Mgmt. System	Highway Mgmt. System	Intermodal Mgmt. System	Drainage Mgmt. System
NJ	X	X		X							X
NY	X	X	X	X							
NC	X	X									
ND	X	X									
OK	X										
PA	X										
PR											
SC	X	X									
SD	X	X	X								
TX	X	X									
UT	X	X									
VT	X	X	X								
VA	X	X	X								
WA	X	X	X	X							
WV		X									
WI	X	X	X	X							
WY	X	X	X						X		
Totals	30	33	14	6	1	1	1	1	5	1	1

TABLE C-4

Management Systems Under Development							Total States: 22
	General	Bridge Mgmt. System	Pavement Mgmt. System	Safety Mgmt. System	System Type Unspecified	Intermodal Mgmt. System	Congestion Mgmt. System
AL							
AK							
AZ	X				X		
AR	X						
CA							
CT	X						
DE	X	X	X	X			
FL	X				X		
GA	X					X	X
HI	X	X			X		
IL							
IA	X				X		
KS							
KY	X				X		
MD							
MI	X				X		
MN	X						
MS							
MO	X				X		
MT	X				X		
NE							
NV							
NJ	X				X		
NY							

TABLE C-4

Management Systems Under Development							Total States: 22
	General	Bridge Mgmt. System	Pavement Mgmt. System	Safety Mgmt. System	System Type Unspecified	Intermodal Mgmt. System	Congestion Mgmt. System
NC							
ND							
OK	X	X	X				
PA	X				X		
PR							
SC	X				X		
SD							
TX	X						
UT							
VT	X				X		
VA	X				X		
WA							
WV							
WI	X				X		
WY	X				X		
Totals	22	3	2	1	15	1	1

TABLE C-4

For Developing Goals								
	Bridge Mgmt. System	Pavement Mgmt. System	Safety Mgmt. System	Congestion Mgmt. System	Maintenance Mgmt. System	Program Mgmt. System	Traffic Monitoring Mgmt. System	Under Development
AL	X	X	X		X			
AK	X	X	X					
AZ								X
AR								
CA	X	X						
CT	X	X						
DE	X	X						
FL	X	X	X					X
GA	X	X						X
HI		X						
IL	X	X						
IA	X	X						
KS	X	X						
KY	X	X						
MD	X	X						
MI								X
MN	X	X	X					
MS								
MO						X	X	X
MT								X
NE								
NV								
NJ								
NY	X	X	X	X				

TABLE C-4

For Developing Goals								
	Bridge Mgmt. System	Pavement Mgmt. System	Safety Mgmt. System	Congestion Mgmt. System	Maintenance Mgmt. System	Program Mgmt. System	Traffic Monitoring Mgmt. System	Under Development
NC								
ND								
OK	X							
PA	X	X						
PR								
SC								
SD	X	X	X					
TX	X	X						
UT		X						
VT	X	X	X					
VA								X
WA		X	X					
WV		X						
WI	X	X		X				
WY	X	X	X					X
Totals	21	24	9	2	1	1	1	8

TABLE C-4

For Project Prioritization								
	Bridge Mgmt. System	Pavement Mgmt. System	Safety Mgmt. System	Highway Mgmt. System	Congestion Mgmt. System	Construction Mgmt. System	System Type Unspecified	Under Development
AL	X	X						
AK		X	X					
AZ								X
AR	X	X	X					
CA	X	X						
CT	X	X						
DE	X	X						X
FL	X	X	X					X
GA	X	X						
HI								
IL	X	X						
IA	X	X						
KS						X		
KY								
MD	X	X						
MI		X						X
MN	X		X					
MS								
MO								
MT							X	
NE				X				
NV								
NJ	X	X			X			
NY	X	X	X		X			

TABLE C-4

For Project Prioritization								
	Bridge Mgmt. System	Pavement Mgmt. System	Safety Mgmt. System	Highway Mgmt. System	Congestion Mgmt. System	Construction Mgmt. System	System Type Unspecified	Under Development
NC	X			X				
ND	X	X						
OK	X							
PA	X	X						
PR								
SC	X	X						
SD	X	X	X					
TX								
UT		X						
VT		X						
VA	X	X						
WA	X	X	X					
WV		X						
WI								
WY	X	X	X					
Totals	22	24	8	2	2	1	1	4

TABLE C-4

For Capital/Maintenance Allocations				Total States: 13
	Bridge Mgmt. System	Pavement Mgmt. System	Maintenance Mgmt. System	Capacity Under Development
AL		X	X	
AK		X		
AZ				X
AR				X
CA	X	X		
CT				
DE	X			
FL				
GA				
HI		X		
IL				
IA				X
KS		X		
KY				
MD				
MI				
MN	X			
MS				
MO				
MT				X
NE		X		
NV				
NJ				
NY				

TABLE C-4

For Capital/Maintenance Allocations				Total States: 13
	Bridge Mgmt. System	Pavement Mgmt. System	Maintenance Mgmt. System	Capacity Under Development
NC				
ND				
OK				
PA		X		
PR				
SC				
SD	X	X		
TX				
UT		X		
VT				
VA				
WA		X		
WV		X		
WI				X
WY				X
Totals	4	11	1	6

APPENDIX D

Summary of Selected States' Programming Process

Table D-1 provides a summary comparison of the approach taken by nine state transportation agencies to the development of their capital program for highways. The information presented builds on earlier work by the author (14).

TABLE D-1

	Arizona	California
Organization	DOT State Transportation Board has statutory authority to prioritize all highway projects	DOT California Transportation Commission (CTC) sets policy and allocates funds based on projects nominated by Caltrans and regional transportation planning agencies
Program Cycle	5-year construction program updated annually 50-year transportation future plan 25-year systems plan 10-year project priority list	Varies by category: 1, 4, and 7 years
Key Policy Concerns	Routine maintenance Pavement preservation Matching federal aid Reconstruction New highways Nontraffic functions	Preservation Urban congestion relief Interregional roads Clean air impacts Safety Federal and local matching funds
Program Categories	Interstate completion Interstate reconstruction Controlled access routes (Maricopa and Pima counties) Pavement preservation Noninterstate major construction Bridge, rail crossing, hazard elimination Transportation system management	State Highway Operation and Protection Program (SHOPP) State Transportation Improvement Program (STIP) Traffic Systems Management Plan (TSM) Other
Needs	Analysis of statewide needs or specified funding amounts for certain categories	Analysis of statewide needs
Fund Allocation	Department policy; some geographical controls on road-related revenues Transportation Board can adjust funding levels by category <i>Fund allocation methods currently under revision</i>	Allocated by Commission, subject to statutory geographic split and minimum distribution by geographic area to be fulfilled in 5 years
Priority Ranking	Multiple objectives, including air quality and consistency with regional plans Cost-benefit analyses of several categories Significant role of district engineer recommendations Sufficiency ratings are a major tool Criteria receive equal weight, but are not combined into a total score <i>Methods of prioritization currently under revision</i>	Done at regional level (counties, then RTPOs) for categories other than SHOPP SHOPP and interregional roads prioritized by Caltrans with input from rural counties Regional process involves a technical screen and a policy screen, followed by a scoring based on technical merit, policy priority, and degree to which air quality control measures are included Regional process supports enhancement of the interregional road network CTC reviews each program using a set of statutory and policy criteria

TABLE D-1

	Minnesota	New York
Organization	DOT with eight Transportation District Offices MPOs and Regional Development Commissions coordinate local and regional planning input to Statewide Transportation Plan and STIP Area Transportation Partnerships (ATPs)	DOT with 11 Regional Offices that have program development and management authority, within DOT-approved goals and policies
Program Cycle	3-year STIP Mn/DOT Districts encouraged to develop a short-range work plan for a 6-year time frame, to include projects in the STIP and a 3-year Project Work Plan A listing of project studies beyond the 6-year period also encouraged District multimodal long-range plans developed on a time frame of 10 years or longer	5-year program developed annually
Key Policy Concerns	Emphasis on preservation and management, with safety as key overriding criteria	Safety Infrastructure preservation
Program Categories	Statewide priority goals (1996-1998) <ul style="list-style-type: none"> • Preservation: 30-40% of investment • Management and Operations: 5-15% of investment • Replacement: 25-35% of investment • Expansion: 15-25% of investment 	
Needs	Based on statewide and regional analysis	DOT sets statewide program goals for system condition and performance, with performance measures and project selection criteria identified
Fund Allocation	Target federal funding levels estimated for each area based on economic formula; calculation factors include regional contributions to trust fund compared with statewide income State funds allocated for statewide initiatives, federal match, necessary district set-asides Final allocations based on priority goals and objectives, modal balance, and equity analysis	Initiated 5-year highway and bridge capital program of \$12.6 billion Dedicated preventive maintenance budget for each region DOT develops 5-year program annually within each region, working cooperatively with local offices
Priority Ranking	Eight different regional processes for project selection Sufficiency/deficiency ratings are dominant ranking criteria Some use of benefit-cost analysis, cost-effectiveness measures	MPOs and Regional Offices develop independent ranking and selection mechanisms Technical rankings using accomplishment and condition data from pavement, bridge, congestion, and safety management systems Project readiness; cost-effectiveness; benefit-cost analysis

TABLE D-1

	Oregon	Pennsylvania
Organization	DOT Transportation Commission establishes policy and adopts transportation program	DOT with field offices; 15 MPOs; 7 Local Development Districts State Transportation Commission sets policy direction through Commonwealth Transportation Policy Plan Strategic Plan and MPO/Local Development District Long-Range Plans guide program investment
Program Cycle	4-year program cycle updated biennially	12-year Transportation Program 4-year constrained STIP/TIP program; revised annually
Key Policy Concerns	Preservation Needs-based funding Cost-effectiveness Economic growth, environmental concerns, and livability Congestion mitigation Alternative modes	Interstate and highway restoration Bridge replacement and restoration Increased project costs
Program Categories	Preservation Modernization Operations safety Miscellaneous (includes CMAQ and enhancement) Bridge Public transportation	Bridge rehabilitation and replacement Betterments Interstate/expressway restorations Congestion reduction Safety and mobility Major projects (new facilities/services)
Needs	Analysis of statewide needs within and across program categories	"Maintenance first" approach Identify and project system needs using management systems data
Fund Allocation	Established by the Oregon Transportation Commission (OTC), including <ul style="list-style-type: none"> Programming allocations of available federal funds \$98 million/pavement preservation \$50 million/bridge \$30 million/safety Approximately \$54 million/year for modernization 	Target fund levels provided to field offices and MPOs Allocations set by DOT in negotiation with MPOs
Priority Ranking	Statewide priorities established cooperatively by regions, headquarters, and OTC Technical ranking and scoring used for modernization; projects funded by HBRR hazard elimination, enhancement, CMAQ, railroad crossing protection projects Flexibility in adjusting the scheduling of projects Development of Multimodal Investment Criteria to help prioritize projects is in progress	Range of target values/minimum program levels provided by DOT to field offices Bridge sufficiency ratings; pavement management data; accident data; International Roughness Index (IRI)

TABLE D-1

	Texas	Washington
Organization	DOT Transportation Commission establishes policy, adopts highway program, and has discretionary authority over group of projects in program	DOT Transportation Commission establishes policy for the DOT, adopts Statewide Multimodal Transportation Plan (SMTP), approves DOT budget, authorizes legislative requests
Program Cycle	10-year program with biennial updates or biennial or annual allocations to districts 20-year Strategic Mobility Plan	6-year plan programmed biennially
Key Policy Concerns	Preservation Safety Mobility	Safety Preservation Mobility (passenger and freight) Economic development Environmental and energy conservation Planning and programming Finance
Program Categories	Added Capacity and New Location 1. Interstate Highway System-Construction 2. Interstate Highway System-4R Construction 3. Primary, Secondary, and State System-Construction Other Categories 4. Interstate, Primary, Secondary, and State System-Rehabilitation and Upgrade 5. Farm to Market and Ranch to Market Road System-Rehabilitation 6. Urban System/Principal Arterial Street System (PASS) -Construction 7. Preventive Maintenance-Construction 8. Bridge Replacement and Rehabilitation 9. Miscellaneous-Construction	Maintenance Preservation Improvement Operations
Needs	Statewide estimates of deficiencies or specified funding amounts for certain categories	Estimate of all statewide needs refined to Service Objectives Needs based on desired performance improvement A list of Financially Constrained Needs developed by prioritizing objectives
Fund Allocation	Depends on program category <ul style="list-style-type: none"> Amount fixed by statute Match of federal funds Determination by Commission in consultation with Department Set minimum level of system preservation at approximately 43% of program	Target funding levels established for each category based on needs analysis, fiscal constraint, and regional equity analysis Allocations adjusted during program evaluation
Priority Ranking	Added Capacity or New Location <ul style="list-style-type: none"> Ranked on basis of cost-effectiveness Statewide ranking performed by Central Office Other Categories <ul style="list-style-type: none"> Funds allocated by formulas to districts Districts exercise discretion in project selection within categories Criteria include cost effectiveness, sufficiency/deficiency ratings 	Service objectives set to meet policy objectives Prioritization criteria set for each program area consistent with service objectives Technical rankings based on benefit-cost analysis and other criteria as appropriate

TABLE D-1

Wisconsin	
Organization	DOT Transportation Projects Commission helps shape Major Projects Program only Contracts with counties for all routine maintenance
Program Cycle	6-year program updated every 2 years Unified highway/transit fund
Key Policy Concerns	Economic development Urban improvements (including multimodal) Preservation
Program Categories	Maintenance Existing highway (3R) Major project Interstate Bridge
Needs	Statewide analysis of deficiencies
Fund Allocation	Legislative <ul style="list-style-type: none"> • Maintenance • Major project • All others WisDOT <ul style="list-style-type: none"> • Existing highway • Interstate • Bridge
Priority Ranking	Some controls to maintain program stability over time Multiple objectives, deficiency criteria; guidelines on appropriate improvement Cost-benefit analyses for significant capacity improvements (major project, 3R) No overall score (except major projects) Allow flexibility in project selections Districts have individual processes for prioritization within an assigned budget DOT provides advisory criteria Goal to provide management systems data to districts

APPENDIX E

Case Studies

This section provides 11 case studies that describe aspects of individual states' overall programming approach. Each state has been selected because it offers an example of a particular approach or innovation that furthers the capacity and quality of the agency's programming and project selection work.

- **Alaska**—Alaska has undertaken an ambitious goal of comprehensive modernization of its intermodal NHS network over a 12-year period, while supporting the local infrastructure needs of Alaskans through a prioritization process that scores and ranks projects at both regional and statewide levels.

- **California**—Substate organizations manage much of the strategic planning and multimodal analysis in California. Caltrans works with district offices to prioritize projects. A sample is provided of Caltrans' use of condition scores and highway classifications to prioritize pavement projects.

- **Florida**—Florida's use of quantitative measures and annual work program reviews supports FDOT's capacity to set program funding levels and to examine tradeoffs on both a program level and on a multimodal level.

- **Illinois**—Illinois DOT and the state's six MPOs have been developing fiscally constrained multiyear programs for the past 20 years. Illinois' programming is supported by strong MPO capacity and the effective use of management systems to develop program goals and establish funding levels.

- **Kansas**—Kansas is currently concluding a major capital program, and is anticipating reduced state revenues after 1997. KDOT's Construction Priority System assists it in setting priorities for its programs in Interstate roadways, Non-Interstate Roadways, and Bridges.

- **Michigan**—Michigan is developing a Transportation Management System (TMS) that will integrate information from its seven individual management systems. MDOT expects the TMS to support its ability to develop goals and objectives based on system performance and customer satisfaction.

- **Minnesota**—Mn/DOT has created eight substate Area Transportation Partnerships to integrate regional priorities in the development of its STIP. Mn/DOT's focus is to strengthen relationships among "traditional" and "new" partners in the capital planning process. Mn/DOT investment priorities emphasize preservation and safety throughout the state.

- **Nevada**—Nevada's newly designed Silver State Mobility Management Program integrates performance reporting and evaluation to support its investment decision making. Projects are scored on operational and congestion measures. The program manages data through NDOT's Transportation Information System and its Geographic Information System capacity.

- **New York**—New York uses statewide DOT goals and MPO-based selection and ranking mechanisms to define program objectives. Tradeoffs are made on a regional level to

achieve statewide goals for system condition while meeting regional needs and resource commitments.

- **Pennsylvania**—Taking a "maintenance first" approach, PennDOT uses a wide range of quantitative data to define program objectives and system performance. Target values and minimum program levels are established based on condition and safety data.

- **Washington**—Recent legislation has revamped Washington's approach to programming its highway capital construction projects. The new priority programming process develops a 6-year investment program. WSDOT's use of evaluation criteria and performance measures enables it to clearly link policy objectives to its programming decisions.

ALASKA DEPARTMENT OF TRANSPORTATION (1, 2) REGIONAL AND STATEWIDE PRIORITIZATION

Modernization of Alaska's NHS

The Alaska Department of Transportation has developed a 12-year program of modernization to improve its portion of the National Highway System (NHS), much of which is presently far below national condition standards. Alaska's portion of the NHS network is perhaps among the most unusual. Comprising 2,100 miles of highway and 1,900 miles of marine highway, Alaska's NHS is a truly intermodal system linking major population centers with natural resources, industrial sites, military bases, recreational destinations, and international border crossings. The state's 4,000 NHS miles make up only 2.5 percent of the nation's total NHS system, although the service area—over 586,000 square miles with vast areas of rugged and sparsely settled territory—represents about 17 percent of the nation's land area.

Priority Setting

Alaska DOT's rehabilitation of its NHS routes is planned to take place over two federal budget cycles, from 1996 to 2007. Projects are scheduled for action in four 3-year time periods, based on the following factors:

- Adequacy of highway's width, grade and alignment or condition of marine terminal or vessel;
- Level of use;
- Construction efficiency;
- Annual leveling of effort;
- Maximum utilization of federal funding categories; and
- Completion of current projects.

Setting Priorities for Non-NHS Facilities

A key planning issue for Alaska DOT has been balancing the needs of local and city transportation facilities, which are used daily by the majority of Alaskans, with the needs of the NHS system. Alaska has developed a scoring and ranking system for its non-NHS facilities that is based on a matrix of standards, scoring criteria, and weight factors. Separate "Evaluation Process Standards and Scoring Criteria" are established for the following infrastructure types:

- Rural and urban streets and roads on the contiguous roadway system or Alaska Marine Highway System but not on the NHS (14 standards) (see Table E-1);
- Remote roads and trails (12 standards);
- Transit projects (14 standards);
- Alaska Marine Highway System (14 standards); and
- Stand-alone TRAAK (Trails and Recreational Access for Alaska) projects (12 standards).

In addition, Alaska has developed a "Harbor Evaluation and Selection Process" ranking and scoring system, based on nine standards.

Proposed projects are first evaluated and scored at the regional office level. The highest-scoring projects are then forwarded to a statewide project evaluation board for final scoring and ranking. The final capital program is set based on statewide scores. One interesting aspect of Alaska's prioritization system is the specific criteria that give credit to projects that have local government support. Local support may be through a contribution to project design/construction cost or to ongoing operations and maintenance costs. By giving scoring weight to local contributions, Alaska DOT encourages increased local participation to maximize the use of state and federal dollars. As an example, Table E-1 illustrates Alaska's ranking system for non-NHS rural and urban streets and roads.

Use of Management Systems

Alaska DOT is currently using pavement, bridge, and safety management systems to develop program goals, and is using its pavement management system to help establish projects and desired amounts for pavement rehabilitation work. Alaska uses its public transit management system as a tool in establishing transit funding levels.

Multimodal Tradeoffs

Alaska uses area plans to set regional program goals and direction, and uses multimodal goals to choose projects. Tradeoffs between road and ferry projects for NHS routes are based on Departmental policy and on relative need. For non-NHS projects, although projects are scored using mode-specific criteria, the scoring system (described above) is designed to enable projects to be compared across modes.

TRAAK enhancement projects are ranked only within mode.

Fund Allocation and Resources

For 1996, Alaska DOT's budget is approximately \$120-\$125 million for non-NHS projects; \$80 million for secondary roads, transit, and non-main line ferry; and \$20 million for TRAAK enhancements.

Performance Measures

Alaska reports the use of four straightforward performance measures to evaluate its work:

1. Are the highways we are planning to bring up to current standards brought up to standards within the expected timeframe?
2. Are the miles of deficient pavement dropping as quickly as desired?
3. Is the number of deficient bridges declining?
4. Are we able to meet or exceed current standards for ferries?

California Department of Transportation (Caltrans) (3, 4)

In California, both Metropolitan Planning Organizations (MPOs) and Regional Transportation Planning Agencies (RTPAs) have important roles in capital programming and project scheduling, with much of the strategic planning and multimodal analysis managed by these substate organizations. The California Transportation Commission, on a biennial basis, adopts a 7-year fund estimate that directs the development of state and local capital programs.

Priority-Setting Tools

Caltrans has developed detailed priority-setting processes for various state programs, most of which are related to Caltrans' safety, rehabilitation, operational improvements, and protective betterment projects. (4) Caltrans "Priority Manual" provides direction to districts on identifying and scoring projects in the following categories:

- Land, buildings, and facilities improvements;
- Bridge restoration and replacement;
- Roadway reconstruction and restoration;
- Major damage restoration;
- Highway planting restoration;
- Safety roadside rest area restoration;
- Protective betterments;
- Safety improvements;
- Community noise attenuation;

TABLE E-1

ALASKA DOT EVALUATION PROCESS STANDARDS AND SCORING CRITERIA

(rural and urban streets and roads on the contiguous or Alaska Marine Highway System, but not on the NHS; this category may also be used to score roads of a similar character not on the contiguous system, such as Nome-Council)

Standards	Scoring Criteria				
	(5)	(3)	(0)	(-3)	(-5)
1. Economic benefits following construction Weighting: 2	Supports significant new, identifiable, permanent economic opportunities or benefits statewide or interstate	Supports moderate new, identifiable, permanent economic opportunities or benefits regionally or locally	Supports minimal, speculative or temporary economic opportunities or benefits or provides non-crucial benefit to existing economic activity	N/A	N/A
2. Health and Quality of Life (Air and water quality, neighborhood continuity, access to basic necessities) Weighting: 1	This project provides a significant contribution to improved health or quality of life through reduction or removal of existing negative factor	This project provides a moderate contribution to improved health or quality of life through reduction or removal of existing negative factor	Project will have no affect either positive or negative on quality of life issues	This project provides a moderate degradation to health or quality of life	This project provides a significant degradation to health or quality of life
3. Safety Weighting: 5	60% - 80% = 4 80% - 100% = 5	5% - 20% = 1 20% - 40% = 2 40% - 60% = 3	Less than 5% of project addresses safety	N/A	N/A
4. Improves intermodal transportation or lessens redundant facilities Weighting: 2	Would clearly reduce the need for capital investment in another mode and result in a reduction in operating costs by reducing redundancy in our system or greatly improves the connection between modes for travelers or freight	May reduce the need for capital investment in another mode and result in a reduction in operating costs by reducing redundancy in our system or would moderately improve the connection between modes for travelers or freight	Does not impact other mode requirements	May increase demand on another mode possibly requiring additional capital expenditure	Will increase demand on another mode requiring additional capital expenditure
5. Local, other agency or user contribution to fund project development Weighting: 4	Contribution provides state match, design, right-of-way, and materials	Contribution provides any two: state match, design, right-of-way, or materials	Contribution covers no capital costs; contributes nothing	N/A	N/A
6. Departmental M&O costs and priority and local, other agency or user contribution to fund M&O costs Weighting: 5	Very high M&O priority; or a local government will assume ownership if currently a DOT & PF facility; or sponsor will assume ownership of another DOT & PF facility of similar M&O costs	Moderate M&O priority; or a local government will assume full M&O responsibility; or sponsor will assume full M&O of another DOT & PF facility of similar M&O cost	Not an M&O priority; little affect on M&O costs; sponsor contributes nothing	Not an M&O priority, would increase M&O costs moderately	Not an M&O priority; would increase M&O costs significantly

TABLE E-1 (Continued)

Standards	Scoring Criteria				
	(5)	(3)	(0)	(-3)	(-5)
7. Public Support for the Project? Weighting: 3	Preponderance of public record including a resolution from the local elected body shows support for project and fully supported in official state/local plans	Majority of public record shows support for project; and nominally supported in official state/local plans	Public record is divided or undocumented toward project	Majority of public record shows opposition to project; and not supported in official state/local plans	Preponderance of public record shows opposition to project including a resolution from the local elected body and contravenes official state/local plans
8. Environmental Considerations Weighting: 1	Environmental approval likely with Categorical Exclusion or already complete	Environmental approval likely with Environmental Assessment or draft document circulated	Environmental approval likely with Environmental Impact Statement	Environmental approval extremely difficult 50/50 chance	Environmental approval unlikely
9. Surface Rehabilitation Weighting: 4	Primarily 3-R and a PMS recommendation for rehab within 2 years, or a gravel surface badly deteriorated or serious surface deformation	Primarily 3-R; a portion of the project addresses serious foundation problems	Primarily major reconstruction; addresses longer-range rehabilitation	N/A	N/A
10. Cost, length, AADT evaluation. Divide project cost by length and further divide result by Avg. Annual Daily Traffic Weighting: 4	Between: 0-55¢ = 5 55 - 80¢ = 4	Between: \$.80 - \$1.10 = 3 \$1.10 - \$1.50 = 2 \$1.50 - \$2.50	Between: \$2.50 - \$3.00 = 0	Between: \$3.00 - \$4.00 = 1 \$4.00 - \$6.00 = 2 \$6.00 - \$10.00 = 3	Between: \$10.00 - \$54.00 = -4 \$54.00 - ∞ = -5
11. Deficient bridges Weighting: 3	Deficient bridge needing replacement	Deficient bridge eligible for repair/ replacement	No bridge deficiencies	N/A	N/A
12. Deficient width/grade/alignment Weighting: 3	Significantly deficient w/g/a relative to standards	Moderately deficient w/g/a relative to standards	No w/g/a deficiencies	N/A	N/A
13. Functional Classification Weighting: 2	Major Arterial = 5 Minor Arterial = 4	Major Collector or Urban Collector	Minor Collector	Local Roads/Streets	N/A
14. Other factors not specified Weighting: 2	Project exhibits significant innovation, creativity or unique benefits not otherwise rated	Project exhibits moderate innovation, creativity or unique benefits not otherwise rated	Project exhibits no innovation, creativity or unique benefits not otherwise rated	N/A	N/A

- School noise attenuation;
- Highway planting;
- Safety roadside rest areas;
- Roadside enhancement (vista points);
- Operational improvements;
- HOV operational improvements;
- Ridesharing facilities; and
- New highway construction.

Figure 5 illustrates Caltrans' use of condition scores and highway classifications to prioritize pavement reconstruction and restoration projects. As shown in the figure, priorities vary by problem type and highway class. For example, the top priority is addressing major statewide structural problems and bad ride quality on Class 1 highways. New facilities and capacity-increasing operational improvements are mostly prioritized by MPOs.

California statutes set the following sequence for priorities:

1. Operation, maintenance, and rehabilitation of the state highway system (including the seismic retrofit of bridges);
2. Safety improvements where physical changes (other than adding additional lanes) would reduce fatalities and the number and severity of injuries;
3. Flexible congestion relief, traffic management system projects, interregional roads, and public mass transit

- guideways, including intercity rail (new facilities that add capacity to the transportation system);
- 4. Environmental enhancement and mitigation program; and
- 5. Compatibility improvements, including landscaping and noise attenuation barriers.

Use of Management Systems

Caltrans uses its pavement and bridge management systems to develop program goals, and to identify specific projects and set project priorities. These systems provide information that is used to develop the annual maintenance budget,

Multimodal Tradeoffs

The setting of multimodal goals and consideration of multimodal tradeoffs is understood to be primarily an MPO responsibility within California's decision-making structure.

Program Tradeoffs

Caltrans sets a higher priority and overall program funding level for preservation activities. Once the program funding

Problem Type		Priority Category		
		Highway Class		
		1	2	3
Ride Score ≥ 45	Major Structural Problem and Bad Ride Flex: Alligator B = 11-29% & Patching > 10% or Alligator B ≥ 30% Rigid: 3rd Stage Cracking ≥ 10%	1.xxxxx	2.xxxxx	11.xxxxx
	Minor Structural Problem and Bad Ride Flex: Alligator B = 11-29% & Patching ≤ 10% Alligator B ≤ 10% & Patching > 10% Alligator B = 0% & Patching > 20%	3.xxxxx	4.xxxxx	12.xxxxx
	Bad Ride Only	5.xxxxx	6.xxxxx	
Ride Score < 45	Major Structural Problem and Bad Ride Flex: Alligator B = 11-29% & Patching > 10% or Alligator B ≥ 30% Rigid: 3rd Stage Cracking ≥ 10%	7.xxxxx	8.xxxxx	13.xxxxx
	Minor Structural Problem and Bad Ride Flex: Alligator B = 11-29% & Patching ≤ 10% Alligator B ≤ 10% & Patching > 10% Alligator B = 0% & Patching > 20%	9.xxxxx	10.xxxxx	14.xxxxx

FIGURE 5 California DOT HA-22 reconstruction and restoration program PMS priority system.

level is established, the preservation program is developed from the highest-priority projects from the various programs.

Performance Measures

Caltrans is evaluated annually on its ability to deliver projects within the programmed year and within the programmed cost. The goal is to deliver 90 percent of projects and 100 percent of programmed value by advancing projects from future years. The agency is also investigating establishing more detailed performance measures of the various capital programs.

FLORIDA DEPARTMENT OF TRANSPORTATION PRIORITY-SETTING AND MULTIMODAL TRADEOFFS

Priority-Setting Tools

The Florida Department of Transportation (FDOT) uses quantifiable measures to establish funding allocations for specific programs. Inspection data are collected and analyzed through various management systems.

Pavement Condition—for the entire State Highway System is measured annually to determine the extent of deficient pavement. The magnitude of pavement deficiencies is one factor considered to set the funding level for the resurfacing program. Specific projects are selected by district staff from candidate projects on the deficiency list. Resurfacing projects must be within a predetermined rating range to be eligible for funding.

Bridges—are inspected at least biannually. Bridges maintained by FDOT are listed on an annual deficient bridge list, which is used to establish the funding level of the Bridge Replacement and Bridge Repair programs. FDOT's objective is to program all structurally deficient bridges in the Five-Year Work Program, in addition to a large portion of other bridges having structural deterioration. Bridges must be on the deficiency list to be programmed with Five-Year Work Program funds.

A Maintenance Condition Survey—conducted annually measures specific data at sites selected on a random sample basis throughout the year. This information is used to generate an overall rating, which is used to determine funding for the Routine Maintenance program.

Results of all three surveys are summarized and published annually by FDOT in its *Program Objectives and Accomplishments* report.

Use of Management Systems

FDOT currently uses its pavement, bridge, and safety management systems as tools to assist decision makers in developing program goals, establishing program funding levels, and setting project priorities. FDOT is moving toward implementation of congestion, intermodal, and public transportation management systems.

Multimodal Tradeoffs

Goals and objectives for the state transportation system are established by the Florida Transportation Plan (FTP), which includes both long-range (25 years) and short-range (within 10 years) components. Multimodal goals are also defined in modal system plans (e.g., Aviation, Rail, and Seaports). Specific policies are developed to support the implementation of the FTP. For example, to encourage multimodal alternatives, Florida has established a policy that sets a maximum number of lanes on the State Highway System that may be provided by Department funds. FDOT has also established standards as benchmarks for identifying intermodal linkage deficiencies on connectors to key intermodal facilities of statewide significance. FDOT finds that for most corridors, both highways and public transportation are required. The Maximum Lane policy limits the level of travel demand that can be satisfied by highways in the form of general use lanes; alternative forms of transportation including HOV, transit, and rail may be considered to satisfy additional demand.

Specific multimodal tradeoff decisions are made through policy direction and by consensus determination at the district and local levels.

Program Tradeoffs

To determine fund allocations among programs, FDOT starts by determining the fund levels necessary to meet program objectives within the Resurfacing, Bridge Replacement and Repair, and Maintenance Programs, using the techniques described above. Funds allocated to Public Transportation programs are based on Florida law, which specifies a set minimum percentage of state transportation revenue that must be programmed for public transportation. Funds for FDOT operation are set aside as necessary. Capacity improvement projects may be funded by the remaining funds.

Performance Measures

FDOT conducts Work Program review sessions for all FDOT programs on an annual basis, prior to the development of the next year's work program. Unit costs for bridge repair, replacement, and resurfacing projects are monitored and reported annually. A transit performance report is also prepared each year. FDOT and the Florida Transportation Commission also evaluate performance at the conclusion of each five-year work program.

ILLINOIS DEPARTMENT OF TRANSPORTATION (5, 6, 7, 8) OVERVIEW OF PROGRAMMING PROCESS

The Illinois Department of Transportation (IDOT) has nine district offices and works with 12 MPOs. Illinois' MPOs are well established and have had an active role in transportation decisions for many years.

Illinois' long-range state transportation plan, *Connecting Illinois*, was adopted in March 1995. The plan identifies six policies to govern IDOT's programs and actions, and establishes strategies to accomplish each of these policy goals. The policies direct IDOT activities to achieve improvements in the following areas:

- Economic enhancement;
- Mobility, reliability, and safety;
- System preservation and management;
- Congestion, efficiency, and intermodal connections;
- Environment and energy; and
- Transportation planning, coordination, and finance.

Fund Allocation and Resources

Illinois' proposed Statewide Transportation Improvement Program for FY 1996–1998 totals \$7.11 billion, of which \$3.19 billion is allocated for highway improvements and \$3.92 billion for transit improvements. The highway element of the STIP includes \$1.963 billion of federal funds (approximately 62 percent of the total highway budget), \$1.032 billion of state funds (32 percent) and \$191 million of local funds (6 percent). The highway program includes \$1.5 billion of projects reflected in the state MPOs' TIPs; \$258 million of "significant projects" identified individually, and \$1.4 billion of grouped projects.

TABLE E-2

ILLINOIS HIGHWAY PROJECTS—PROPOSED ACCOMPLISHMENTS AND RESOURCE ALLOCATIONS BY PROJECT CATEGORY

Illinois Department of Transportation FY 1996–98 Grouped Highway Projects (\$ Millions)						
ID #	Category		FY 1996	FY 1997	FY 1998	FY 1996–98
1	Resurfacing includes pavement resurfacing, rehabilitation and/or reconstruction widening narrow pavements without adding travel lanes, truck climbing lanes outside the urbanized area, shoulder improvements, increasing sight distance, and other associated activities.	Miles	961	749	1,023	2,733
		Cost	199	182	270	651
2	Bridges include the repair, rehabilitation, or reconstruction of existing system bridges, or the construction of a grade separation to replace existing at-grade railroad crossings, and other associated activities.	Number	214	176	176	566
		Cost	80	80	81	241
3	Safety includes highway safety or traffic operation improvement projects including signalization and other intersection improvements, skidproofing, railroad/ highway crossing improvements, and other associated activities.	Intersections	153	159	145	457
		Cost	40	31	35	106
4	Enhancements include non-traditional projects which are "over and above" normal transportation activities and include such projects as bicycle trails and rehabilitation of historic transportation buildings.	Cost	35	62	29	126
5	Other engineering, right-of-way, lighting, etc. Includes engineering and land acquisition associated with non-specific projects that can be grouped, emergency relief, lighting, rest areas, and weigh stations.	Cost	122	109	72	303

Source: Illinois Department of Transportation, Statewide Transportation Improvement Program FY 1996–98: Proposed Highway & Transit Improvement Program, October 1995.

Both IDOT and the state's MPOs have been developing fiscally constrained multi-year programs for the past 20 years.

Priority-Setting Tools

IDOT uses pavement condition, structure condition, congestion, and safety to develop its project backlog and accruing needs list. All projects that are backlog or accruing needs or are high-accident locations are considered as candidates for the multi-year program. IDOT uses its pavement and bridge management systems to develop program goals and to establish program funding levels, in addition to their use for project identification and prioritization. Mode-specific criteria within each mode are used to set priorities.

Table E-2 shows Illinois' proposed achievements and allocation of resources by project category for its highway program in FY 1996.

Performance Measures

Each year IDOT publishes *For the Record*, a report that provides detailed, project-specific status of program accomplishments against overall objectives. The report provides a mechanism for public review by the General Assembly, media, public officials, and the general public of IDOT's accomplishments and project scheduling revisions.

**Kansas Department of Transportation (9, 10, 11, 12)
Construction Priority System**

Fund Allocation and Resources

The Kansas Department of Transportation (KDOT) is in the midst of a Comprehensive Highway Program authorized by the state Legislature, which is scheduled to end in 1997. The agency's resource base will change significantly at the conclusion of this capital program, after which no state money will be available beyond amounts needed to match federal aid. KDOT expects its program to be considerably reduced at that point.

Priority-Setting Tools

KDOT has developed a Construction Priority System to set priorities for three major programs: Interstate Roadways, Non-Interstate Roadways, and Bridges. Priority formulas are used to rank roads and bridges by priority of need for improvement. The priority ranking that results from the use of these formulas is used to select projects for further consideration. Programming is accomplished in priority order selecting the project with the highest need rating.

Each priority formula is based on a set of attributes that are assigned relative weights. These attributes are then adjusted by a series of adjustment factors that may apply to all or some of the attributes. Table E-3 demonstrates KDOT's priority formula system for non-interstate roadways.

Use of Management Systems

KDOT uses its pavement and bridge management systems to help develop program goals, and the Construction Priority System discussed above to set project priorities.

Multimodal Tradeoffs

Kansas' Long-Range Transportation Plan has recommendations for each mode. However, because the majority of state transportation funding is for roads, with a modest public transportation program, no multimodal program tradeoffs are made.

Program Tradeoffs

KDOT sees a direct correlation between its capital and maintenance budgets. Annual assessments of long-term maintenance requirements are made. When these needs are significant, KDOT considers the economic merit of replacement or major renovation as an alternative to maintenance. Maintenance is sometimes deferred when future replacement of a facility has been chosen as the preferred response to assessed needs.

**MICHIGAN DEPARTMENT OF TRANSPORTATION
(13, 14) TRANSPORTATION MANAGEMENT
SYSTEM DEVELOPMENT**

Priority-Setting Tools

The Michigan Department of Transportation (MDOT) uses a prioritization model for road resurfacing and reconstruction activities as a priority-setting tool on a statewide basis. MDOT is also in the process of developing prioritization models for road widening and expansions. Maintenance costs, traffic, and safety concerns, as well as public and political input are considered on a qualitative basis. At the regional level, program recommendations are largely based on sufficiency information, inspections of roads and bridges, knowledge of Department goals and policies, experience and observations

TABLE E-3

KANSAS DOT ATTRIBUTES AND ADJUSTMENTS USED IN THE NON-INTERSTATE ROADWAY REHABILITATION PRIORITY FORMULA

Attribute	Rel. Wt.	Adjustment Factors*							
		Accident Rate			Posted Speed	Facility		Shoulders	
		High	Med.	Low		Div.	Undiv.	Stab.	Unstab.
Roads:									
No. of narrow structures per mile	.086	1.000	.858	.734	0 to 1				
Shoulder width	.089	1.000	.858	.734	0 to 1	.540	1.000	.607	1.000
No. of SSSD per mile	.069	1.000	.858	.734	0 to 1				
Lane width	.101	1.000	.858	.734	0 to 1	.500	1.000		
No. of SSHC per mile	.099	1.000	.858	.734	0 to 1				
Volume/Capacity ratio	.091								
Commercial traffic	.065					.376	1.000	.519	1.000
Rideability	.088								
Pavement structural evaluation	.208								
Observed condition	.104								

* In addition, roadways are adjusted for classification and AADT.

by staff, and public input. The regional areas also use the Road Quality Forecasting System (RQFS) to define regional strategies in the selection of work types for pavement fixes.

Use of Management Systems

MDOT is in the process of developing an integrated management system consisting of seven individual management systems: pavement, bridge, congestion, intermodal, maintenance, public transit, and safety. MDOT envisions its Transportation Management System as an integrated system that will provide a platform to support coordinated decision making. The systems will be used to:

- Identify strategies and system deficiencies;
- Monitor systems and inventories; and
- Develop goals and objectives based on system performance and customer satisfaction.

MDOT expects its management systems to be operational in 1997, and is currently offering training to MDOT staff in five of these systems.

Multimodal Tradeoffs

MDOT currently sets priorities within each mode consistent with the Michigan Transportation Policy Plan (MTPP) and the State Long-Range Plan (SLRP). MDOT expects the development of its management systems to help establish an environment in which consideration of multimodal solutions is inherent to the project selection process.

Presently, multimodal tradeoffs are made by first identifying transportation system deficiencies, and then developing programs for retiring these deficiencies based on the multimodal solutions available. When comparing multimodal options, factors such as MDOT goals, project cost, environmental impact, and impact on local communities are considered.

Program Tradeoffs

MDOT has developed a 10-year investment strategy known as *Build Michigan*, which identifies preservation versus new capacity program funding levels. This strategy sets the overall program goals and targets consistent with the MTPP and SLRP. As funds increase or decrease on an annual basis, adjustments among these programs may be made by management, consistent with the *Build Michigan* strategy.

MINNESOTA DEPARTMENT OF TRANSPORTATION (15) TRANSPORTATION INVESTMENT PROCESS

Area Transportation Partnerships (ATPs)

The Minnesota Department of Transportation (Mn/DOT) uses a substate geographic focus for the development of its

State Transportation Improvement Program (STIP). Eight Area Transportation Partnerships (ATPs) have been created as the geographic basis for integrating the priorities within the regions of the state. ATPs generally follow the Mn/DOT District State Aid boundaries to facilitate coordination and staffing.

The objective of Mn/DOT's Transportation Investment Process, "Promoting Good Transportation Decisions," is to develop a new, integrated procedure for making federal transportation decisions within Minnesota (see Figure 6). The process is designed to develop an interrelationship between elected officials and transportation agencies and to include both "traditional" and "new" partners in the capital planning process. Traditional partners include the Regional Development Commissions, MPOs, and Mn/DOT Districts along with counties, cities, and townships. New partners include Mn/DOT modal offices, the Department of Natural Resources (DNR), historical societies, Indian tribes, and others.

The primary role of an ATP is to bring together the transportation improvement recommendations of the RDCs, MPOs, and Mn/DOT into an integrated list of transportation investments—the Area Transportation Improvement Program (ATIP)—and to ensure implementation of that program through program management. ATPs may also establish criteria for project selection, participate with Districts in the development of policies and procedures for managing the ATIP, and develop or review priority lists of projects for programs that are not included in the target.

While only federal-aid highway funding is included in the ATP process, Mn/DOT stresses the importance of including information on all transportation investments—including Federal Transit and state funded projects—to assure good investment decisions. Discussing its integration of STIP/TIP documents, Mn/DOT noted that this "... First complete program document with all state and federal projects in one place brought clarification and understanding about transportation investments."

Fund Allocation and Resources

Mn/DOT sets "flexible target funding" for the distribution of federal funds to its eight ATP regions. The target is an estimate of federal funding distributed to each ATP by formula. The target formula is based on a 40/60 split between system size and system usage. The factors representing system size include total statewide bridge area, lane miles on routes eligible for federal aid, and number of transit vehicles. The factors representing system usage include total vehicle-miles of travel, and the state demographer's forecast of population for the year 2020. Each ATP uses this target to develop its Area Transportation Improvement Program. Target levels are not viewed as actual regional shares to be received, however, but rather as planning tools only. There are no guaranteed ranges for project selection based on regional target funding levels.

Mn/DOT anticipates an average annual amount of state funds available for trunk highway construction activities of \$210 million, including an estimated reserve for statewide initiatives of \$10 million.

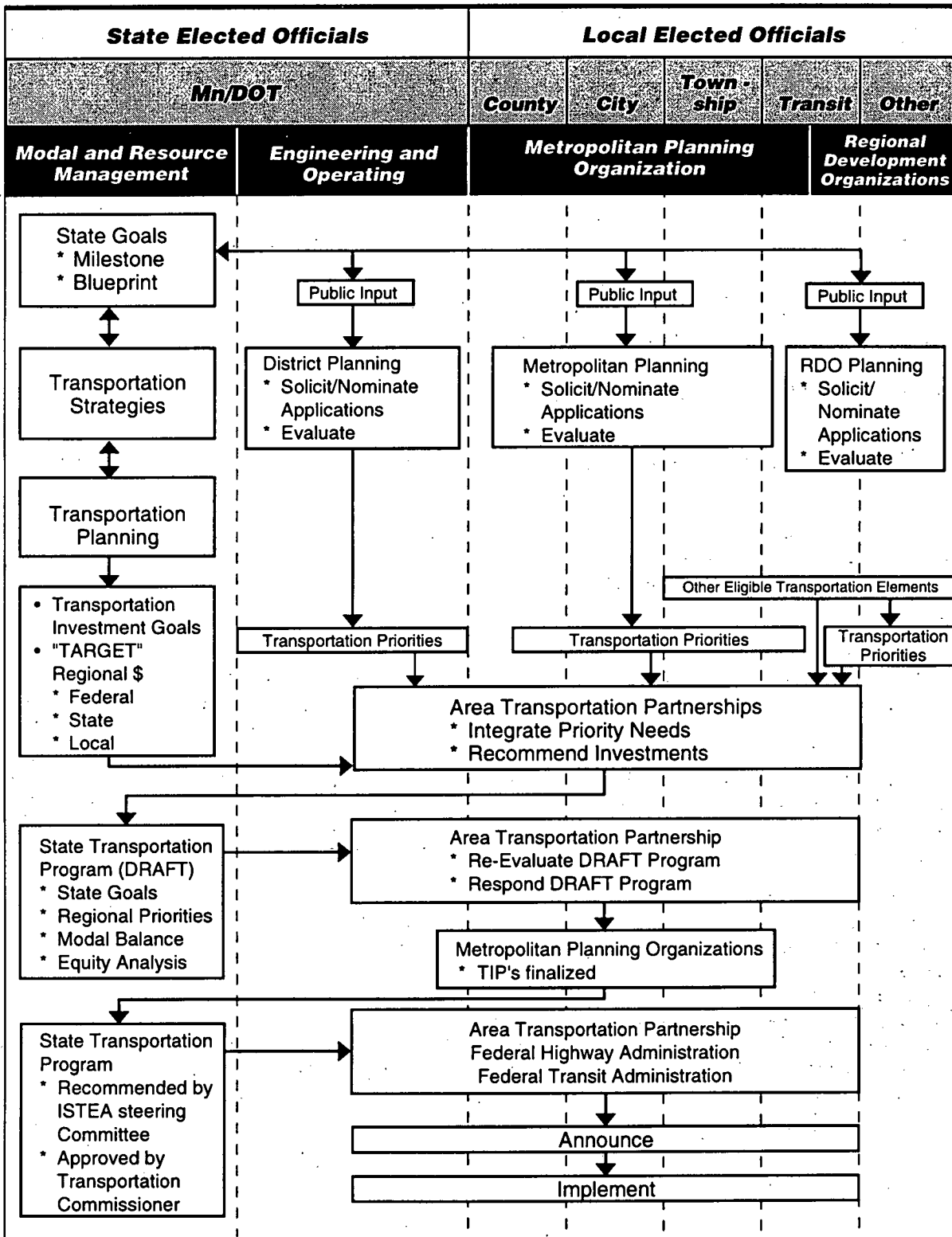


FIGURE 6 Minnesota DOT transportation investment process: Promoting Good Transportation Decisions.

Mn/DOT is preparing state infrastructure banking legislation for the 1997 legislative session.

Priority-Setting Tools

Mn/DOT's principles for making transportation investment priorities emphasize preservation and management of existing systems over capital improvements, with safety as a key criterion involved in selecting projects in all program areas. Mn/DOT has four specific priority goals for 1996–1998:

- Priority 1—Preservation Goal: 30 percent to 40 percent of investment;
- Priority 2—Management and Operations Goal: 5 percent to 15 percent of investment;
- Priority 3—Replacement Goal: 25 percent to 35 percent of investment; and
- Priority 4—Expansion Goal: 15 percent to 25 percent of investment.

State funds are targeted to each Mn/DOT district to be used for the following priorities:

1. Match of federal dollars received through the ATP process and special demonstration projects;
2. District set asides to cover supplemental agreements and overruns;
3. Right-of-way needs to cover all trunk highway (TH) projects; and
4. All other state funded highway and bridge projects, prioritized using the four specific priority goals listed above.

In keeping with Mn/DOT's decentralized approach to setting regional priorities, each ATP uses a different process and criteria to identify their priority projects.

Use of Management Systems

Mn/DOT currently makes use of pavement, bridge, and safety management systems to some extent to support strategic decision making. In addition, Mn/DOT's BMS is used to help establish funding levels for maintenance vs. capital funding for bridges. However, Mn/DOT expects that, depending on the stage of implementation of each management system, "useful guidance" from its management systems will be achieved in the next 1 to 3 years.

Multimodal Tradeoffs

Mn/DOT sets modal goals drawn from statewide planning and policy studies. Modal goals are developed for bicycle, transit, rail, ports and waterways, aeronautics, and highways. Priorities usually are based on mode-specific criteria, within each mode. Mn/DOT reports that their use of multimodal

goals is limited, due in part to a lack of understanding of multimodal approaches at the District/ATP level.

Program Tradeoffs

Program funding levels will vary by ATP region, but are subject to overall system performance goals. Mn/DOT uses a number of performance measures to assess program effectiveness in achieving these goals. These measures include: pavement quality index, bridge sufficiency rating, trunk highway sufficiency rating, accident rates, and travel time. Mn/DOT prepares a performance report for the legislature based on its system performance goals.

NEVADA DEPARTMENT OF TRANSPORTATION (16) THE SILVER STATE MOBILITY MANAGEMENT PROGRAM

The Silver State Mobility Management Program

The Nevada Department of Transportation (NDOT) has developed the Silver State Mobility Management Program (SSMMP) as a systematic process for project selection and funding. Developed in cooperation with the state's two MPOs, the SSMMP's goal is to "Assist NDOT to allocate resources to the most critical transportation problems." The process is in its first year of implementation.

SSMMP is based in Nevada's Transportation Information System (NITS), and permits performance reporting and evaluation to be integrated. SSMMP uses a Geographic Information System to provide fully interactive geographic and tabular databases. The SSMMP is used to help NDOT evaluate projects for its STIP (1 to 3 years) and Long-Range Element (4 to 10 years). Only the first year of the STIP has committed Department funding.

Priority-Setting for Mobility Projects

NDOT produces a performance evaluation titled *State of the Transportation System Report*. This evaluation provides the basis for assigning point values to specific projects and project types. Projects are assigned points based on how they perform with regard to Operational Measures and Congestion Evaluation:

- Operational Measures:
 - Volume to Capacity (v/c) Ratio;
 - Number of Through Travel Lanes.
- Congestion Evaluation:
 - Percent Change in Volume to Capacity Ratio;
 - Ten-Year Projected Percent Increase in Traffic Volume; and
 - Benefit/Cost Evaluation.

The range of points for each criterion has been assigned so that the projects will address the systemwide needs identified in the *State of the Transportation System Report*. Projects that do not meet the minimum point level are not considered further during that funding cycle. Projects that do meet these threshold criteria are further evaluated for programming.

**NEW YORK STATE DEPARTMENT OF
TRANSPORTATION (17, 18)
OVERVIEW OF PROGRAMMING
PROCESS**

New York State Department of Transportation (NYSDOT) operates in a decentralized decision-making environment, and delegates program development and management decisions to its 11 Regional Offices. Overall direction for NYSDOT is developed through Department-approved goals and policies. NYSDOT has also implemented a Project and Program Planning and Management procedure and organization over the last 5 years, which includes staff in each Region responsible for program and project development and management. This region-based focus includes working with MPOs and other local officials to develop the TIP and STIP.

New York State has 12 MPOs, which historically have had a strong role in programming. Voting members of New York's MPOs include NYSDOT and transit authorities. TIPs have been fiscally constrained since before ISTEA legislation.

Fund Allocation and Resources

New York State recently initiated a \$12.6 billion 5-year highway and bridge capital program. The program includes both federal and state funding and will address state and local transportation systems.

NYSDOT develops a 5-year program annually within each Region, with assumed resource levels. The Department works with MPOs and local officials to develop the program; if fund levels change significantly, the same participants work cooperatively to adjust the program.

Priority-Setting Tools

NYSDOT uses statewide DOT goals and MPO selection and ranking mechanisms to define program objectives. Detailed goals for each program area are developed, with specific performance measures, project selection criteria, and improvement guidelines. Examples of NYSDOT's approach are provided in Table E-4 for the program areas of pavement and congestion. The Department uses accomplishment and condition data for pavement, bridge, and congestion in models to predict future conditions. Each MPO has developed its own criteria to evaluate and prioritize projects. In non-urbanized areas, the Department's regional offices take on a similar role.

Use of Management Systems

NYSDOT uses pavement, bridge, congestion, and safety management systems to develop program goals and identify specific projects and priorities. Pavement, bridge, and safety management systems are also used to assist in establishing program funding levels. Management systems are assigned to various Divisions within NYSDOT. NYSDOT also is implementing a Program MIS to assure ready access to timely and consistent project and program information.

Multimodal Tradeoffs

A multimodal approach is taken to identify cost-effective solutions to both highway and transit "congestion" and "capacity" problems. NYSDOT's congestion goal and its technical tools emphasize evaluation of all modes during scoping of individual projects. The Department works with the Metropolitan Transportation Authority (New York City) and other relevant organizations to ensure cooperative evaluation of congestion in all modes.

Program Tradeoffs

The general philosophy of NYSDOT is to set statewide goals for system condition, but to avoid region-specific goals, letting regions make tradeoffs to balance goal achievement and resource commitments. Within this approach, safety and infrastructure preservation have been priorities. There is a dedicated preventive maintenance budget for each region; regions are also encouraged to allocate additional funds from capital as effective. NYSDOT also seeks to program projects to optimize overall system condition, rather than the condition of individual elements or projects.

Performance Measures

Performance measures and project selection criteria are set for each goal. Performance is assessed annually and adjustments are made as needed.

**PENNSYLVANIA DEPARTMENT OF
TRANSPORTATION (19, 20, 21, 22)
OVERVIEW OF PROGRAMMING
PROCESS**

Priority-Setting Tools

PennDOT uses bridge sufficiency ratings, pavement management data, accident data, and the International Roughness Index (IRI) as quantifiable measures to define program objectives and system performance. Program guidance is issued to PennDOT's field offices that set a range of target values, and minimum program levels are established based on the above ratings and data.

TABLE E-4
NEW YORK STATE SELECTED GOALS, PERFORMANCE MEASURES, AND PROJECT CRITERIA

State of New York Department of Transportation State Fiscal Years 95/96—99/00 Statewide Goals	
<i>State Pavement</i>	
Goal:	Maintain state highway pavement and related appurtenances in a condition of good repair. Stabilize pavement conditions as measured by the percentages of pavement in poor and fair condition and by the average surface condition rating at no worse than the 1986 statewide levels (10% poor, 26% fair, and 7.0 average surface condition). Maintain higher volume roads to an overall higher condition level than lower volume roads.
Performance Measures:	Percentage of overall lane miles and percentage of high-volume lane miles with pavement surface score less than 6 ("poor" pavement). Percentage of overall lane miles and percentage of high-volume lane miles with pavement surface score equal to 6 ("fair" pavement). Average surface condition rating.
Project Selection Criteria (In Priority Order):	<ol style="list-style-type: none"> 1. Prevent structural failure and repair critical damage. 2. Develop an integrated pavement program of rehabilitation projects utilizing the Department's pavement management system tools. Minimize life cycle costs of system maintenance and repair. 3. All other factors being equal, give priority to projects on specially identified routes or corridors selected on the basis of volume, functional class, or commercial truck traffic, or similar criteria. 4. Distribute program benefits equitably among counties.
<i>Congestion/Mobility</i>	
Goal:	<p>Maximize reduction of projected vehicle hours of delay at LOS "E" or "F" (VHD) on state highways, through cost-effective (VHD/\$M) TSM, TDM, and selected linear capacity projects.</p> <ol style="list-style-type: none"> 1. Program highly cost-effective congestion/mobility projects (daily VHD/\$M in project year of at least 25, but in Regions 8, 10, and 11 daily VHD/\$M of at least 50). 2. Program cost effective transportation system management projects and operational improvements that achieve a 10% reduction in the growth in VHD. 3. Program \$2.00 million per year for TDM initiatives of which \$500,000 per year/per region is allocated for Regions 8, 10, and 11, to increase the vehicle occupancy rate during the peak periods.
Performance Measures:	<p>Region's total baseline recurring daily VHD at LOS "E" and "F" in 1994. Region's projected recurring daily VHD at LOS "E" and "F" at the end of the GOP period with and without improvement:</p> <p>Total reduction of VHD through:</p> <p>Programmed TSM projects and operational improvements</p> <p>Programmed TDM projects</p> <p>Programmed linear projects</p> <p>Number of centerline miles operating at LOS "E" or "F" (V/C>1) at the beginning and end of the GOP period with and without program improvements.</p>
Project Selection Criteria:	<ol style="list-style-type: none"> A. Program Transportation System Management low cost TOPICS type improvements which are highly cost-effective in reducing VHD. B. Program Transportation Demand Management projects and initiatives which contribute to reductions in single-occupant vehicles through transportation demand reduction strategies. C. Program selected linear capacity projects which are highly effective in reducing VHD. Program projects that are integrated with MPO Long Range Transportation Plans, and local and private land use and development plans to manage growth. Program projects with significant local and/or private financial support when appropriate. D. All congestion projects should consider TSM and TDM alternatives to solve all or part of the problem, including medium-range solutions. E. Select cost-effective TSM and TDM measures for MPT plans, including permanent solutions to remain in place when project is completed.

Source: New York State Department of Transportation, SFYs 95/96-99/00 Statewide Goals (undated).

Use of Management Systems

Pavement and bridge management systems are used to develop program goals and funding levels and to identify and prioritize projects.

Multimodal Tradeoffs

Multimodal goals are defined in PennDOT's Strategic Plan and Policy Plan. Priorities are set within each mode. Multimodal tradeoffs are made on a project-by-project basis as they are developed.

Program Tradeoffs

The Commonwealth's Transportation Policy Plan, PennDOT's Strategic Plan, and MPO and Local Development District long-range plans provide overall guidance to the program development process. These planning documents emphasize a "maintenance first" approach, and stress initiatives to:

1. Maintain, manage and improve the Commonwealth's existing transportation systems;
2. Strengthen planning and programming processes; and
3. Develop plans and programs that preserve and reinforce environmental quality and livable communities.

Within this framework, most highway and bridge funding for the 1997–2000 cycle is targeted toward preservation and improvement. The Department provides guidance to its field offices on level of funding by program area. Using its "maintenance first" strategy, funding for key programs—including Interstate Restoration, Highway Restoration, and Bridge Replacement and Restoration—are recommended at minimum acceptable levels.

WASHINGTON DEPARTMENT OF TRANSPORTATION (23, 24) LINKING PERFORMANCE MEASUREMENT TO PROGRAMMING DECISIONS

A New Approach to Capital Programming

In 1993 the Washington State legislature passed RCW 47.05, landmark transportation legislation that enacted new objectives and approaches to priority programming of highway capital construction projects. RCW 47.05 changed both the structure and the process of Washington State's highway program. Key changes included:

- A broadened focus to seek multimodal solutions that address highway system deficiencies;
- Elimination of former legislation that listed an explicit "order of call" on funds;
- A requirement instead that the priority programming system serve explicit policy objectives related to 1) system

preservation, 2) mobility, 3) support of the state's economy, and 4) environmental protection and energy conservation;

- A requirement that prioritization and tradeoffs leading to project selection be based on rational methods;
- A multimodal approach to project development that considers a broad range of potential solutions; and
- A requirement for measures of performance that can be monitored to assess the accomplishment of each biennium's program and to make adjustments in the subsequent program.

The result of the priority programming process as defined by RCW 47.05 is a biennial budget request developed within a comprehensive 6-year investment program that also embodies a statement of program objectives, a needs analysis, and performance measures.

Performance Measures

To manage the requirements of RCW 47.05 and to take full advantage of the new level of flexibility it provides, Washington State Department of Transportation (WSDOT) has developed a system for priority setting based on program-level performance measures and priorities. The use of explicit evaluation criteria and performance measures enables WSDOT to link policy objectives, planning, and programming. Separate goals for each program area are established, and quantifiable objectives identified for each program goal. Annual performance measures are then set to monitor WSDOT's progress in achieving these objectives (see Figure 7).

Three types of performance measures are identified:

1. System Performance Measures (improvements achieved in the transportation system);
2. Program Delivery Performance Measures (workload accomplished); and
3. Efficiency Performance Measures (workload or "products" accomplished relative to level of resources used).

The following sample "Performance Measures and Priorities by Program" (Table E-5) demonstrates the use of this system to monitor and evaluate WSDOT's progress in accomplishing its goals. The results of these performance measurements form the basis for a progress report to stakeholders—executives, WSDOT staff, the legislature, and the traveling public.

Multimodal and Program Tradeoffs

The Washington Transportation Commission is required by statute to adopt a statewide, multimodal transportation plan (SMTP). This comprehensive plan, still under development (as of December 1995), will address both state-owned facilities and "state interest" facilities—that is, transportation facilities that are owned and operated by other entities, but are important to the overall transportation system. The SMTP will include all modes (see Figure 8).

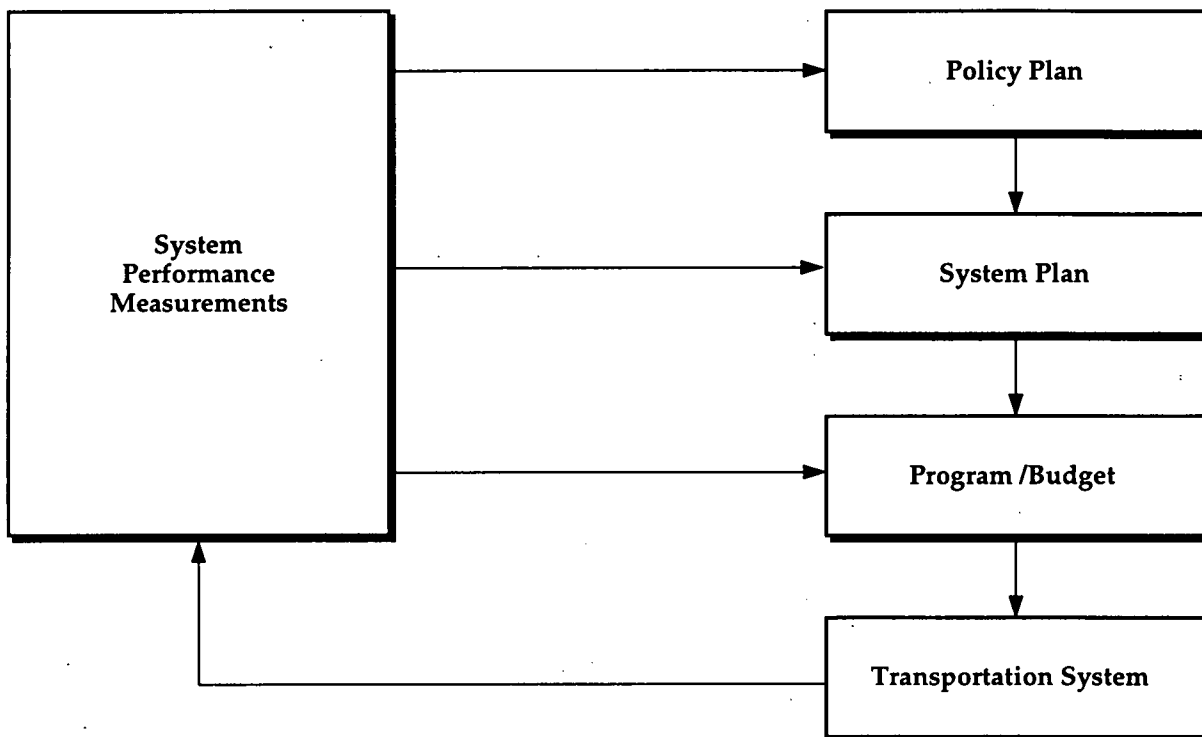


FIGURE 7 Performance measurement in Washington state. (Source: Ziegler, Brian J., P.E., *Transportation Planning and Performance Measurement in Washington State*, December 1995).

TABLE E-5

WASHINGTON STATE DOT PERFORMANCE MEASURES AND PRIORITIES BY PROGRAM

Form B11		Code		Page	
State of Washington		Agency	405	Department of Transportation	
Biennial Budget Estimates		Program	P00	Preservation	
Date: September 1, 1995		Subprogram	P1, P2	Roadway, Structures	
Program Functional Area: Transportation and Infrastructures		Code		T1	
Priority	Goal Statement:				
03	Preserve the structural integrity of the existing highway system.				
Code	Objectives:				
03A	Repave highways at regular intervals to minimize long-term costs. Restore existing safety features				
03B	Reduce the risk of naturally caused catastrophic bridge failures.				
03C	Rehabilitate or replace existing bridges and other structures to preserve operational and structural integrity.				
Code	Outcome Measures	FY 1994	FY 1995	FY 1996	FY 1997
03A-1	Reduce the number of lane miles that have substandard pavement ratings			2826	1921
03B-2	Reduce the number of bridges in need of seismic retrofit	914	881	852	788
03C-3	Reduce the number of bridges in need of rehabilitation/replacement	159	158	155	155
Code	Workload Accomplished (Output)	FY 1994	FY 1995	FY 1996	FY 1997
03A-1	Number of lane miles rehabilitated (new starts only)			954	905
03B-2	Number of bridges seismic retrofitted (new starts only)	75	33	29	64
03C-3	Number of bridges rehabilitated/replaced (new starts only)	4	1	3	0
Code	Efficiency Measures	FY 1994	FY 1995	FY 1996	FY 1997
03A-1	% of planned lane miles			84%	85%
03B-2	% of planned retrofits	100%	100%	100%	100%
03C-3	% of planned rehabilitation	100%	100%	95%	100%

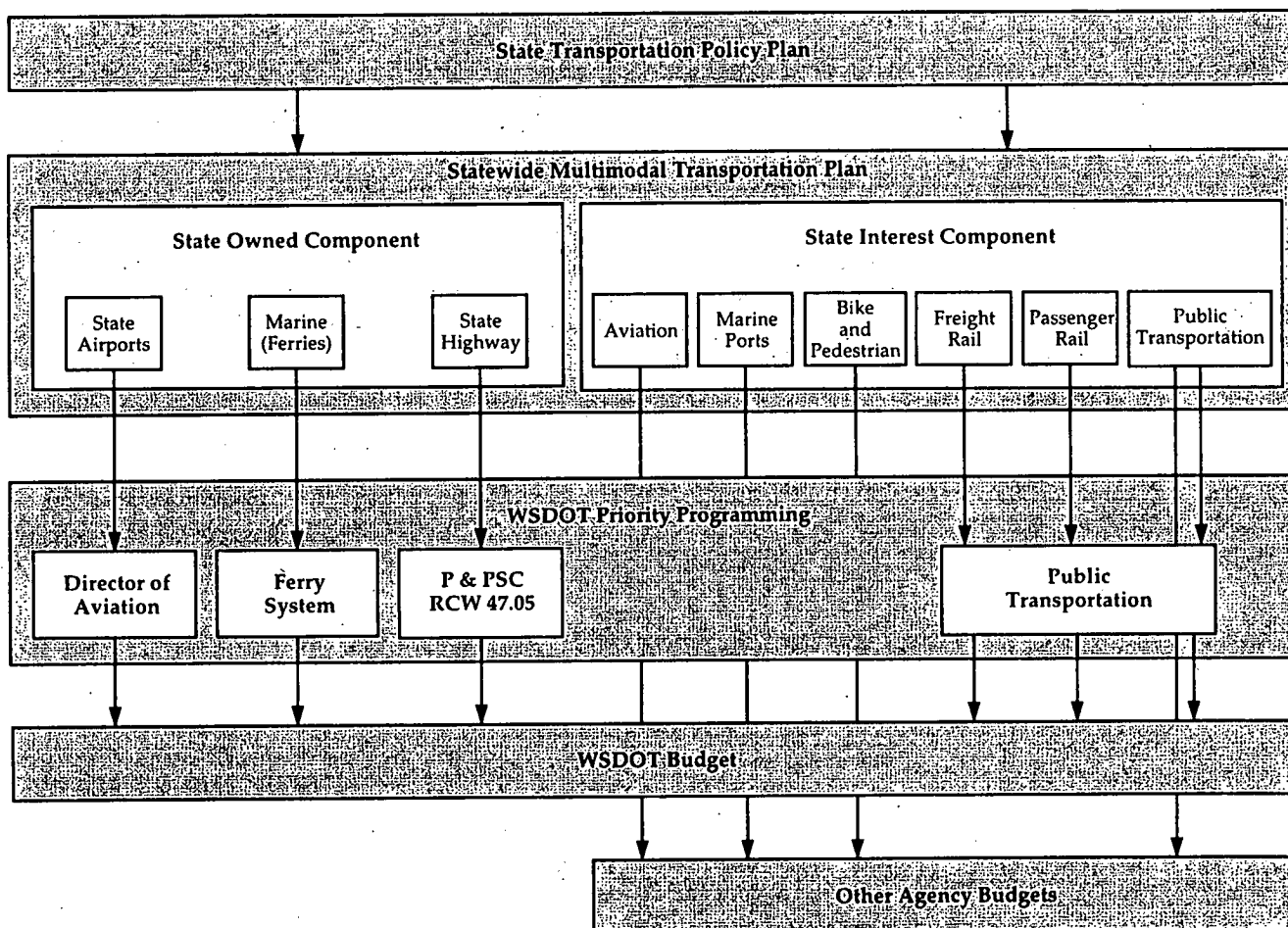


FIGURE 8 Transportation planning and programming in Washington state. (Source: Ziegler, Brian J., P.E., *Transportation Planning and Performance Measurement in Washington State*, December 1995)

Specific multimodal goals and objectives are being set by WSDOT for each mode within the SMTP. These objectives are used to set program direction for individual modes, using mode-specific criteria. Multimodal tradeoffs are made via policy-level proposals adopted by the Transportation Commission, based on staff recommendations. These proposals are submitted to the legislature for consideration and appropriation.

Tradeoffs among programs and project categories are based on three factors:

- Cost/Benefit;
- Performance Measures; and
- Policy Concerns.

Program funding level recommendations are made by WSDOT management to the Transportation Commission, which then submits proposals to the state legislature.

Threshold Criteria and Project Prioritization

WSDOT also uses threshold criteria to limit the number and type of projects that are formally evaluated and prioritized. These thresholds are listed as follows:

Project Type	Threshold Criteria
Paving Projects	Pavement structural condition (PSC) of 50
Urban Mobility Deficiency Projects	Level of Service value of "D" or worse
Rural Mobility Deficiency Projects	Level of Service value of "C" or worse
Safety Risk Deficiency Projects	Deficiencies must have the potential of 2.5 or more vehicle encroachments per year

Projects that meet these threshold criteria are then prioritized for programming based on criteria consistent with the objectives set for each program area. Prioritization tools include rankings based on facility condition, benefit-cost analysis, and other measures as appropriate.

Use of Management Systems

WSDOT uses its pavement and safety management systems to develop program goals and establish program funding

levels. The pavement management system is specifically used to assist in setting roadway maintenance versus preservation/capital funding levels. Pavement, safety, and bridge management systems are used to identify specific projects and set project priorities.

WSDOT's Capital Program Management System (CPMS) is used to manage the agency's highway capital construction program. CPMS contains detailed information on project descriptions, cost, schedule, workforce requirements, and thresholds for all potential capital projects. The system is linked to WSDOT's executive information system and accounting system, and provides a primary source of technical information for highway construction projects.

REFERENCES FOR APPENDIX E

All case studies are based on the survey responses as provided by the respective state transportation agencies (See Appendix B) supplemented by additional materials as listed.

Alaska

1. *Alaska's National Highways: Draft Plan*, Alaska Department of Transportation and Public Facilities, September, 1995.
2. *Evaluation Process Standards and Scoring Criteria*, Alaska Department of Transportation and Public Facilities, September, 1995.

California

3. *Priority Manual*, California Department of Transportation (undated).
4. *Multimodal Project Application*, Metropolitan Transportation Commission (MTC) (September 25, 1995).

Illinois

5. *Bridge Structure Square Foot Construction Cost* for calendar year 1995, Illinois Department of Transportation (May 1996).
6. *Proposed Improvements for Illinois Highways FY 1996*, Illinois Department of Transportation (July 1995).
7. *FY 199-2001 Proposed Highway Improvement Program*, Illinois Department of Transportation (Spring 1996).
8. *Statewide Transportation Improvements Program, FY 1996-1998 Proposed Highway and Transit Improvements Program*, Illinois Department of Transportation (October 1995).

Kansas

9. *Weights of Attributes and Adjustment Factors in the Priority Formula for Interstate Roadways*, Kansas Department of Transportation (March 1988).

10. *Weights of Attributes and Adjustment Factors in the Priority Formula for Non-Interstate Roadways*, Kansas Department of Transportation (October 1988).
11. *Weights of Attributes and Adjustment Factors in the Priority Formula for Bridges*, Kansas Department of Transportation (October 1988).
12. *Transportation Programming Process in Kansas*, Kansas Department of Transportation, Division of Planning and Development, presentation for Transportation Research Board Conference on Transportation Programming Methods and Issues, Irvine, CA (December 3-6, 1995).

Michigan

13. Petko, Theresa, "Role of ISTEA Management Systems in Priority Setting and Program Development" (December 4, 1995).
14. "The TMS Toolbox: Update on the Transportation Management System of the Michigan Department of Transportation," Volume 1 Number 2, Michigan Department of Transportation (April 1996).

Minnesota

15. "ISTEA Implementation Guidance for Development of Minnesota's 1996-1998 State Transportation Improvement Program (STIP)" (December 14, 1994).

Nevada

16. *Project Evaluation for NDOT's State Transportation Improvement Program and Long Range Element*, Nevada Department of Transportation, Program Development Division (April 1996).

New York State

17. Statewide Goals (including performance measures, project selection criteria, improvement guidelines) for: Bridges, State Pavement, Congestion/Mobility, and Safety, New York State Department of Transportation (December 1992).
18. Shufon, J., C. Fosdick, B. Gigliotti, J. McClean, "Developing and Implementing the ISTEA Management Systems: New York State's Approach" (March 1994).

Pennsylvania

19. "Moving PennDOT Forward with Service, Integrity and Performance," *1995 Strategic Plan*, Pennsylvania Department of Transportation (1995).
20. *Pennsylvania Transportation Policy Plan and Executive Summary*, Pennsylvania Department of Transportation (December 1995).
21. *PennDOT User's Guide to Transportation Planning and Programming*, Pennsylvania Department of Transportation (March 1996).
22. *Program Update to STIP/TIP*, Pennsylvania Department of Transportation (February 1996).

Washington State

23. Ziegler, Brian J., P.E., "Transportation Planning and Performance Measurement in Washington State," December 1995, presented to the Transportation Research Board Conference on Transportation Programming Methods and Issues, Irvine, CA (December 3-6, 1995).
24. *Highway Capital Construction Programming: Briefing Book*, Washington State Department of Transportation, prepared by Cambridge Systematics, Inc. (December 1995).

THE TRANSPORTATION RESEARCH BOARD is a unit of the National Research Council, a private, nonprofit institution that provides independent advice on scientific and technical issues under a congressional charter. The Research Council is the principal operating arm of the National Academy of Sciences and the National Academy of Engineering.

The mission of the Transportation Research Board is to promote innovation and progress in transportation by stimulating and conducting research, facilitating the dissemination of information, and encouraging the implementation of research findings. The Board's varied activities annually draw on approximately 4,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation.

The National Academy of Sciences is a nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce Alberts is president of the National Academy of Sciences.

The National Academy of Engineering was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encouraging education and research, and recognizes the superior achievements of engineers. Dr. William A. Wulf is president of the National Academy of Engineering.

The Institute of Medicine was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences, by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Kenneth I. Shine is president of the Institute of Medicine.

The National Research Council was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Bruce Alberts and Dr. William A. Wulf are chairman and vice chairman, respectively, of the National Research Council.

Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

NON-PROFIT ORG.
U.S. POSTAGE
PAID
WASHINGTON, D.C.
PERMIT NO. 6970

ADDRESS CORRECTION REQUESTED

000021-05
Robert M Smith
Research & Asst Matls
Idaho DOT
P O Box 7129
Boise ID 8